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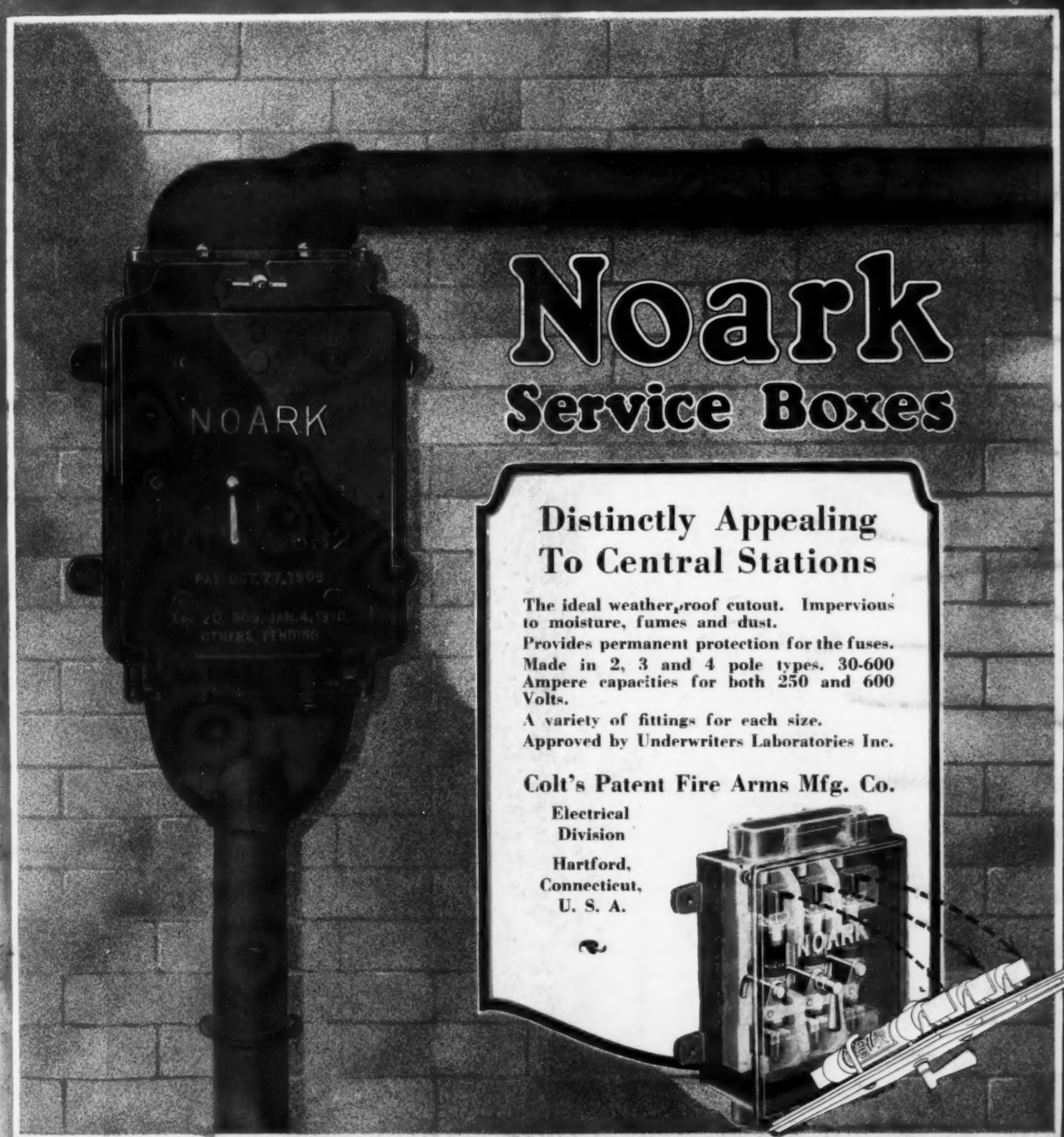
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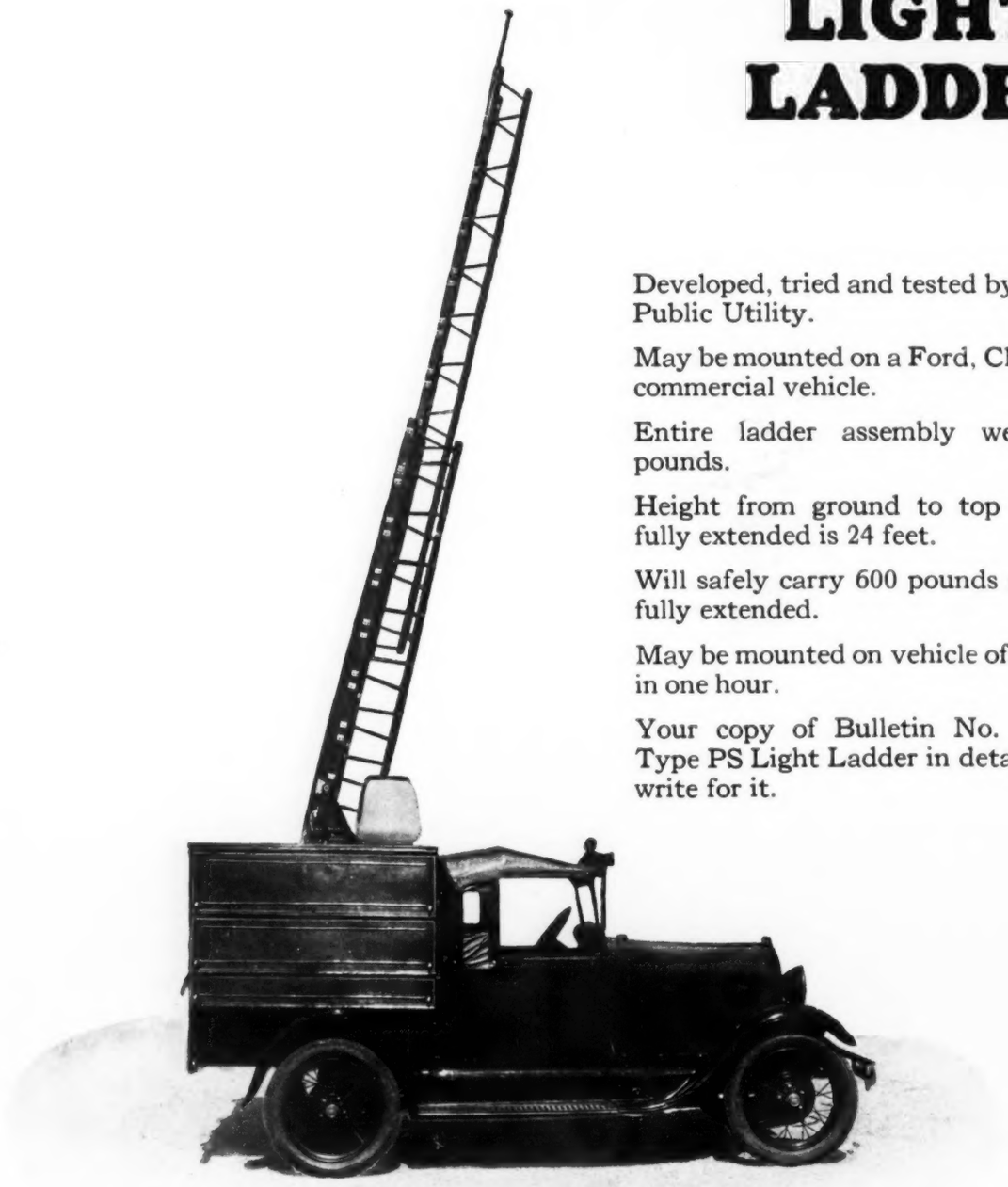

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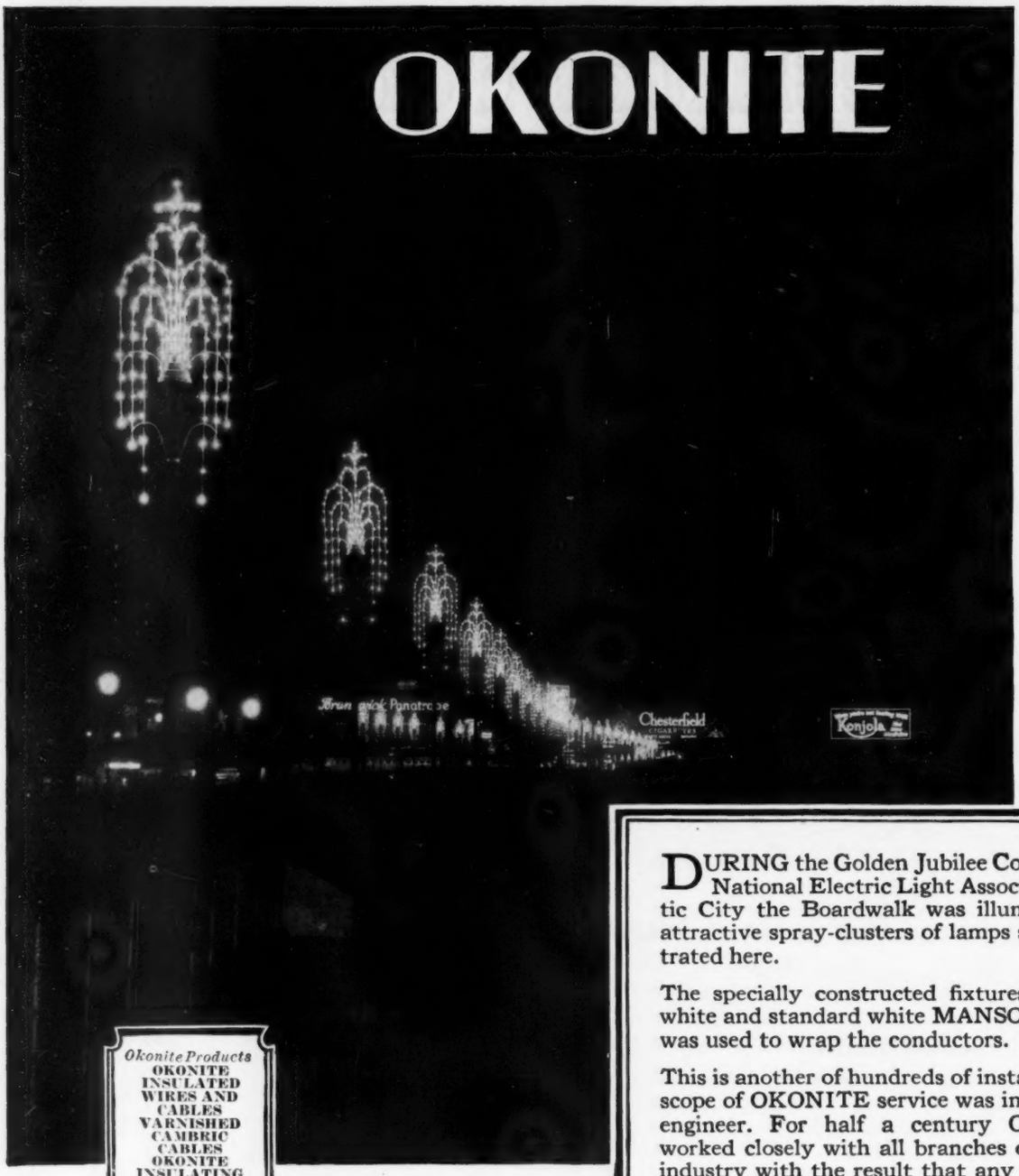

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Electrical World

A McGraw-Hill Publication—Established 1874

L. W. W. MORROW, *Editor*

Volume 94 *New York, Saturday, August 17, 1929* Number 7

Utility Securities and the Slump in Stocks

THE slump in the stock market last week, attributed to the action of the Federal Reserve Bank of New York in raising the rediscount rate, while it did not affect the general run of utility securities appreciably, served to direct attention to the spectacular rise of some utility stocks since May. Of course, with a limited number of shares available for trading purposes, any demand will send prices skyward, and utility stocks are no exception. But the price paid for a few hundred shares does not establish the market value of many thousand shares. As a rule an offer to sell a block of a thousand shares of any but the largest utility company would break the market in that stock. Fortunately, the market for utility stocks is rendered more or less stable by the activities of investment trusts, which are the chief purchasers of such stocks.

None the less, the tremendous expansion of utility holding companies, however justifiable, is sure to set the tongues of the critics of utilities wagging. And yet the capitalization of equities has been common practice for years in the real estate market. So long as the underlying utility properties are consistent earners, the position of the holding company is secure. But should there be a shrinkage in the earnings of the underlying companies due to improper rate adjustments or to other causes, its effect on the holding company may be very serious. As a matter of fact, some that are heavily mortgaged might be forced to the wall. It is difficult to believe, however, that any reasoned rate cut would lead to anything but increased output and earnings, or that the present rate of progress which the utility industry is making will be suddenly arrested. The future may be discounted in the present market prices of many utility stocks, but those who stick with the industry will have no cause for regrets.

* * * *

Are Higher Distribution Costs Inevitable?

THERE seems to be a large amount of fatalism in the make-up of the distribution engineers and superintendents about the unit investment in distribution systems. They are loath to admit much chance of reducing the costs of installation. In fact, there seems to be widespread certainty that costs will rise in this department of power companies. Longer runs to more remote new customers, heavier consumption by new and old and a high degree of service reliability all point to more, rather than less, cost per customer. Labor-saving appliances may keep the latter item from rising, but city construction is getting steadily more expensive. Traffic interference hinders rapid construction and makes expensive temporary provisions necessary. Highway improvements force plant investments ahead of time.

But executives have declared for lower costs, if possible. They are not likely to be satisfied with the mere reply that costs cannot be reduced. Engineers must be prepared to tell what requirements are increasing costs and, relatively, how much. And if executives are still insistent on greater economy, the engineers will have to protect themselves by explaining what requirements must be modified to permit changes in practice.

With demands for immediate action, it will not be sufficient to rely solely on analysis of the situation within single organizations. Previous experience has demonstrated that the most rapid progress will be made by exchanging ideas between companies. This cannot be done on a broad scale without supplementing conversation with the printed word. Before this can be done, however, some companies will find it necessary to remove some of the existing hindrances to dissemination of information.

* * * *

Census Gives Data for Industrial Market Analysis

THE latest United States Census of Manufactures, features of which are graphically presented in the color section of this issue, can be very helpful to any one charged with business development in the electric utility or the manufacturing business. First of all, the data give tangible proof that industry as a whole has been rapidly increasing its usage of electricity per worker since 1919. It has evidently favored purchased power, since virtually the entire nation's increase in industrial motors has been attached to utility lines. The amount of privately generated power has remained about constant, decreasing slightly since 1919. Even where power is locally produced, there has been an increasing tendency to electrify drives. These facts alone should have significance to industries which still remain to be electrified or convinced of the value of purchased power.

But more important is the fact that the data indicate the industries upon which effort must be concentrated if utilities and electrical manufacturers are to expect more than the normal rate of growth of business. Of course, the industries which have electrified or purchased power extensively have had the chance to experience the benefits thus derived and will be most susceptible to further progress in these directions; but attention cannot be confined to them if the greatest progress is to be made.

There are some industries, like iron and steel furnaces, lumber and timber products, paper and wood pulp, cotton goods, ice manufacture, flour and grain, which still use a great deal of non-electrical horsepower. What will make it more attractive in these fields to use electric drives and purchased power? Is not the fact that many

of the most highly electrified industries are among the most prosperous an indication that electrification is helping in this prosperity and that more industries should follow the lead?

If some outstanding examples in the less electrified industries or those using little purchased power can be induced to follow the national tendency, it will be simpler to convert other industries in similar fields. Obstacles will have to be overcome and convincing data will have to be presented, but will it not be worth the effort if the large unelectrified market is brought to a more sympathetic consideration of the advantages of electric operation from utility circuits?

Finally, to what extent have some of the old electrified undertakings been modernized? Here is a job chiefly for consulting engineers and manufacturers, but in aiding industries in this problem utilities may find new uses for purchased power. Although 78 per cent electrified, industry, when analyzed in the light of facts, still offers wide opportunities for further conversion.

* * * *

Equilibrium in Executive Sales Effort

EQUILIBRIUM is more important to the tight-rope walker than to the man on the ground because he has farther to fall if he loses it. Every man who sets out to do a definite job in any line of business is a tight-rope walker, figuratively, except that he cannot see the rope under him and never knows that his forward foot is properly planted until he puts his weight on it. Direction and balance are his essential senses; if he loses either—too bad. Our subject is the utility sales executive, for he, if he be successful, must be a tight-rope walker *par excellence*.

The electric utility sales executive is in a position different from that of his brothers in other lines of business. They sell the products of their companies directly. He sells the product of his company by indirection. A kilowatt-hour by itself has no commercial standing or customer appeal whatever. It must be sold through the media of devices that can use it and thus give it value. Moreover, the diversity of its uses is such as to give it widely variant values as between classes of consumers and between individuals of any one class. As a general rule electrical energy cannot be sold f.o.b. shipping point. It must be sold delivered to the place of its use. Thus the three elements of production, delivery and utilization of the service must be considered.

For the prosperity of his company the central-station sales manager must attain and always retain a close balance in his energy-selling efforts. He can not oversell to one class of customers and neglect the others, for by so doing he will impair the economic foundation of his company. He must keep all of his sales avenues open and give to each its proportionate share of the traffic. He must be able to control his enthusiasms, to temper them with pessimism if need be; otherwise he may find his efforts dangerously overbalanced.

As a fair example of sales effort extending over a wide front of customer contact, we recommend the set-up in the Public Service Company of Northern Illinois, described in this issue of the ELECTRICAL WORLD. Here are shown a nice appreciation of the comparative values of different classes of customers as energy consumers and a disposition of selling effort accurately gaged to these values.

Effect of Interconnection Upon Operating Analyses

INTERCONNECTION of power systems tends to upset preconceived ideas in subtle ways. Nowhere is this more in evidence than in making the approach to economic analyses of operation. Plant investment, costs and load relationships no longer live unto themselves alone. Segregation of interconnection influences from the system status becomes important when the proportion of interchange power rises from nominal values. Otherwise scrutiny of plant performance, using "plant" in the larger sense, becomes blurred and the engineer is likely to go astray in critical studies of investment behavior.

The preparation and examination of unit data applying to particular generating stations continues to be useful, although interconnected operation often plays havoc with local plant economy. It still is hard for "oldtimers" among operating engineers to subordinate plant efficiency to the over-all economy needs of systems tied together by lines of a capacity that enables a distant load dispatcher to order local participation in load handling to proceed on a basis which would be far from satisfactory to the local plant if judged by the standards of isolated operation. Present-day criteria of judgment on plant operation, however, weigh system performance against everything else and take full account of loading conditions in comparing individual stations.

Emphasis now belongs upon such units as system investment per kilowatt of system capacity (including tie-in power lines), cost of individual stations per kilowatt as affected by interconnection, capital costs and reduction of reserve generating facilities inside the plant, allocated cost of tie lines and local generating plants per unit of capacity for bus delivery, system load and capacity factors in addition to individual station factors, system rating per capita (including and excluding interconnecting lines), "manufacturing" and total costs per kilowatt-hour at the system buses as well as costs at particular plants, and ratios of peaks to system and station ratings. Interconnection has a bearing upon these values which is increasingly significant. The once popular indoor sport of comparing plant performance *per se* has lost its edge in a way, but the fascinating task of seeking maximum efficiency on particular systems challenges engineering interest on a far greater scale.

* * * *

Rising Standards in Industrial Engineering

ECONOMIC pressure is gradually forcing upward the standards of practice in industrial engineering. Nation-wide industries are coming to appreciate the cost of inadequate engineering organizations and are strengthening their forces in order that the problems of design, construction and operation may receive what might be called a more professional treatment. The resources of great organizations are being commandeered for research on an unprecedented scale. Far-sighted executives are placing more responsibility upon the shoulders of the engineers, and their own ranks are being recruited from those of specialists with demonstrated capacity for leadership. The trend is most encouraging, but full momentum has still to be attained among many smaller industrial organizations, to say nothing of some of the larger enterprises.

The electrical engineer is in a fortunate position in this connection. His training usually qualifies him to analyze collateral problems with skill and understanding, and the all-pervading character of electrical service familiarizes the industrially employed electrical man with a broad range of activities. The resources of the art of electrical measurement are today almost unparalleled. Knowledge of processes is rapidly acquired in the atmosphere of a progressive industry, and co-operation with other specialists in the study of plant heat balances, the most effective distribution of power, lighting betterments, elimination of waste, sequence of operations, industrial electric heating, metering of departmental service, improvement of internal transportation and the problems of purchasing power and of interchanging energy with utilities offers the engineer a major opportunity for usefulness. Decisions in these matters are so far-reaching in the larger industries that not a few of these have almost revolutionized their former conceptions of the engineer and his duties, with the result that capital investment is being conserved, net earnings increased, plant development guided with superior control and hit-or-miss methods superseded by systematic programs.

It is only a few years since many industries even of large size looked upon their engineering personnel chiefly as expert "trouble shooters" and construction group leaders. It is to be feared that this attitude still holds back engineering progress in a good many concerns, but the tide appears to be turning even among smaller industrial entities. Engineering co-operation in central-station power sales has been a potent factor in the upward trend and will be still more influential in the future. Consultants report a gratifying increase in the use of their services by progressive industries, although the acceleration is as yet moderate. Much remains to be done in the way of systematizing industrial electrical engineering work within the organizations now turning to it as a valuable tool to increase the over-all efficiency of their production and marketing activities, but the potentialities are being increasingly realized in progressive circles, and with the advent of more general executive recognition the rate of advance will be cumulative.

* * * *

Parkway Cable for Secondary Distribution

ECONOMY in system investment is the watchword and demands the critical analysis of even the most radical departures from the established order. Only thus are the frontiers of practice pressed outward to embrace newer, better, bigger, cheaper or safer ways of accomplishing the day's work. One item that should be subjected to searching scrutiny is the use of single-conductor parkway cables in shallow curb-line trenches as a means of reducing costs of underground distribution in residential areas.

Parkway cable has been used extensively for street lighting, but experience with this construction for secondary distribution has been limited compared with foreign usage. Still, if such cable is laid in a shallow trench inside the curb line and protected by overlying boards or slabs of concrete it may afford a cheaper form of underground construction than is customarily used. A critical analysis of its economy and reliability is needed.

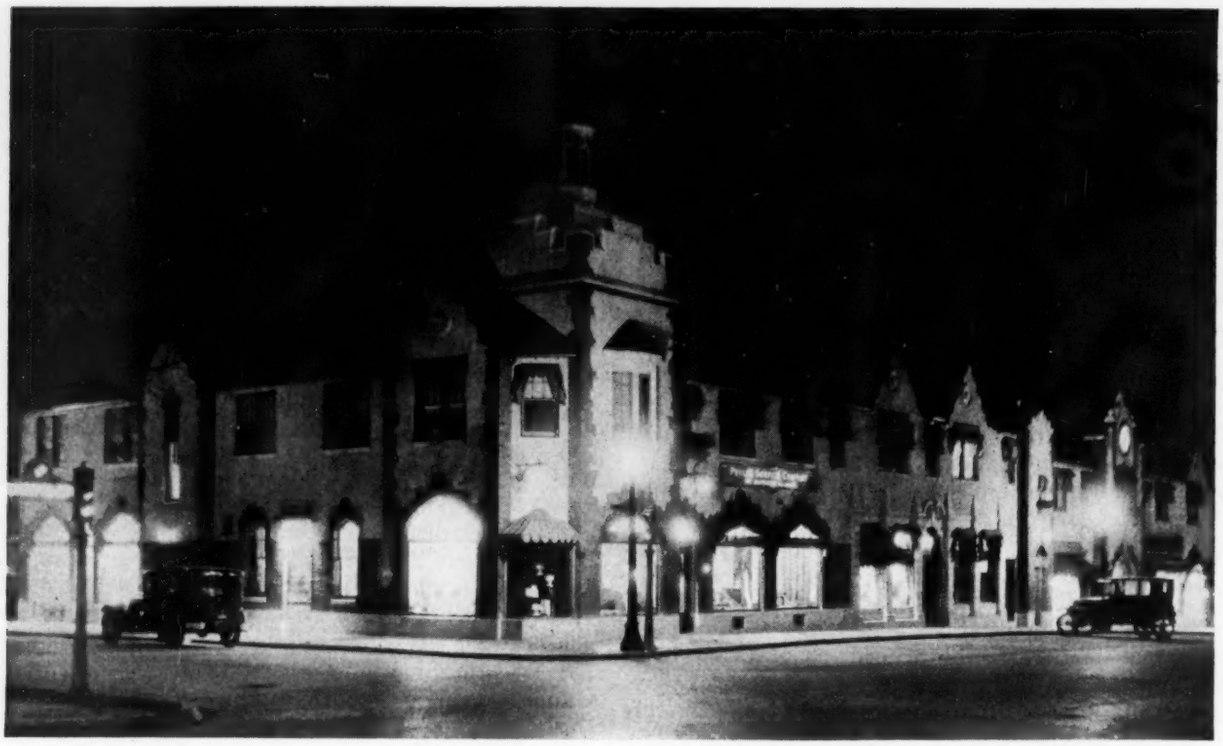
Engineering Betterments in Thinly Settled Areas

MANY engineering problems of importance are being attacked and solved today in connection with the development of sparsely settled territory under centralized management. The public at large has little conception of the amount of money now being poured into plant improvements and expansion in such areas, and of course no conception whatever of the engineering matters involved in this phase of utility work. Occasionally a picture of the engineer's contributions to betterment work in such fields is thrown upon the screen of publicity at commission hearings, and it is fair to say that such views behind the scenes of company development are nearly always of constructive value from the public relations standpoint. In fact, more might well be detailed as to engineering betterments on such occasions, because given fair rates and good public relations, an ounce of concrete information on plant and system progress translated into service improvements offsets a pound of general political propaganda.

In a typical case a local company serving a sparsely settled region about 60 miles long was acquired by a holding company. The energy was obtained from another property at a point almost 100 miles from the system frontier, and interruptions were frequent. Standards of engineering practice under the old régime were chaotic, resources very limited, and line and substations of makeshift design. Six years later the management concern had expended $1,500,000 on the system in physical improvements. A second line had been built to supply energy to the more important sections of the territory, supplementing the first; modern substation designs had been made effective, with the use of automatic reclosing circuit breakers and a well-planned installation of sectionalizing air-break disconnecting switches; submarine cable crossings had been modernized, lightning-arrester protection improved, transformer concentrations established in sections formerly served by too many scattered units, and the distribution potential had been raised in certain important localities from 2,300 to 4,600 volts. Increased copper was installed on important line sections, and service was carried into four additional towns. "Home-made" chicken-wire choke coils gave way to manufactured material of standard caliber, and improved operating practices followed engineering analysis of the causes of former service outages.

Now, it is admitted that work of this kind is always in progress on American power systems, but it is often carried out according to a program so subdivided and of such a piecemeal character that it makes no impression upon the public and very little upon a good many utility executives. It is wholesome for both executives and engineers to integrate the problems of a region to form a comprehensive picture of the entire engineering situation as it relates to quality of service, provision of capacity for load building and group-area earning power. Some handicaps can be removed in this way and existing resources better co-ordinated for future growth. In the case in point conditions have been generally improved and the stage has been set for substantial gains in load. The activities of the commercial department have been rebased on a better engineering and construction job from one end of the property to the other, and centralized technical skill combined with larger financial resources has worked wonders.

Setting a Good Example



THE Public Service Company of Northern Illinois believes in floodlighting its local stores and office buildings. Some of them present a less striking appearance than this one at Libertyville, Ill., but all are creditable improvements in the communities in which they are located and fittingly represent the company in the eyes of the local publics. The company has found the floodlighting of these buildings to be an effective aid in selling that form of lighting service.

Electric Brass Melting

The user's point of view on the operation of arc furnaces in a general jobbing foundry. Lower melting cost, decreased metal losses and better working conditions accompany use of electric heat

By J. B. MEIER

*Vice-President F. and H. Foundry Company, Newark, N. J.**

MORE THAN 2,000,000 lb. of metal has been melted in electric arc furnaces in our foundry Of the 1928 melt, 40 per cent was composition, 48 per cent brass and 12 per cent high lead bearings, a total of a little more than 1,620,000 lb. We have two 350-lb. Detroit Electric furnaces and also a couple of oil fired. The pouring temperature is 2,200 deg. F. The greater part of the work is plumbing supply castings (not pipe fittings), practically all of which are cored. It is jobbing work, not lending itself to advance planning, so that we cannot fully realize the economy of a continuous production schedule. Under these conditions we have found that the electric furnace gives us lower melting costs, a very considerable reduction in metal losses, better control of product and much improved working conditions.

The cost item of first importance is the electric power. This presents a little difficulty in analyzing because of its complicated nature. Power is purchased as primary power, the rate being independent of the connected load, but varying with the maximum demand for any five-minute period during the day. This works a considerable handicap on less than the continuous use of the two furnaces, because a large jump in the demand occurs as soon as the second furnace is operated for five minutes. In addition, the power charge varies with the total consumption, as shown by the data on the chart. These curves are plotted against standard efficiency for various numbers of heats, for different charges.

From experiences we know we can get sixteen heats in 9½ hours with one furnace. We also know the first heat takes about 35 kw. more than those after the fourth. The second heat takes about 15 kw. more and the third about 5 kw. Therefore, to take out four or five heats is not very efficient. To determine just where the second furnace should come in we plotted the curves. They show that if we take sixteen heats our power cost is about $0.0268 per kilowatt-hour, if we take seventeen heats by running one in the second furnace our rate immediately jumps to $0.320 per kilowatt-hour. We find it more economical to run the oil furnaces to take the heats between sixteen up to about twenty-one or twenty-two, as is shown in the graph.

From a study of the chronological chart we find that the cost per kilowatt-hour varies closely with the tons melted per month. Some explanation of these curves will make this clearer. In the beginning of 1927 the cost per kilowatt-hour decreased until May, where it jumped up until the end of July. This radical jump was due to the installation of two silicon-carbide base linings, which caused enormous heat loss and consequent power consumption. Upon removal of these linings the cost dropped, rising gradually as the tonnage dropped, reaching a maximum in February, 1928. From then on it maintained a fair level with a gradual slope, due in part to a change in the casting wall thickness and introduction of nickel brasses, both requiring higher temperatures than previously. The cost per kilowatt-hour has increased in 1928 over 1927 by increased demand charges due to the intallation of a larger transformer and about 40 hp. additional motor load, making a larger demand charge with a smaller increase in power consumed.

The next item of cost is labor. Electric furnace operation requires labor of probably a higher order than for oil, for a careless man can ruin a transformer costing about $1,000 very quickly. But the work is so much less laborious, with practically no heat, that a

This article was produced by a practical foundryman for presentation to the members of his craft. For that reason it can be taken as perfectly unbiased by any promotional animation on the part of electric utilities to sell kilowatt-hours, or of manufacturers to sell electric furnaces. The melting of 2,000,000 lb. of metal in electric arc furnaces gives to Mr. Meier an experience background which entitles his statements to respectful consideration. If he has found—as he has—that the electric furnace, working under the difficult conditions of a jobbing foundry, shows marked economies over other furnaces, we of the electrical industry can hope for no better evidence of the economic virtue of at least this one type of industrial electric heat application.

**Presented at convention of American Foundrymen's Association, Chicago.*

higher grade man can easily be induced to stay on the job. We have had the same furnace men ever since the installation. They are the men who operated the oil furnaces previously used. With oil we always had a high turnover and much absence and tardiness. On the electrics this is practically nil. To melt with oil our labor costs us on the average $3.75 per ton. Compare this with $2.30 in Table I. Further efficiency is

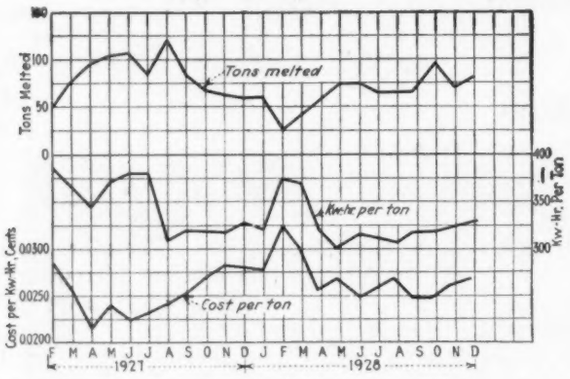


Chart of Economical Furnace Operation

obtained by paying a bonus to the operator as follows: fifty cents for fourteen heats, 75 cents for fifteen heats, $1 for sixteen heats. This urges the operator to get out the maximum amount of metal. The bonus is only paid if it is within 9½ hours. For him to succeed he must run the furnaces efficiently.

The next cost item is electrodes. For the past year this averaged 4½ lb. per ton melted. The type of metal and carelessness on the operators' part are the chief factors involved. Rocking when improperly charged causes breakage. Improper condition of the porthole causes breakage. Clamps which leak contribute to the rapid consumption of electrodes. Improper arcing also burns up electrodes unnecessarily. With a conscientious operator it should not be difficult to bring it down to 4 lb. per ton, for we have done it several months.

Every one is usually interested in the cost of metal loss, but it is impossible to compare it accurately, even in the same shop, if scrap is used, because there is such a large variation in loss in different scrap. In the writer's own experience brass tubing contained 18 per cent scale alone and lead-covered cable contained 8 per cent cotton insulation. The only comparison which can guide to some extent is the metal loss in the same foundry under oil and electric melting. The average of the three previous years of operation under fuel oil was 5.7 per cent. The past year under 85 per cent electric melting and 15 per cent oil melting the loss was 2.4 per cent. Naturally, this is no small item and is one of the chief justifications for electric melting.

Totaling the various items we find a cost of $13.54, exclusive of metal lost, compared with a similar cost of $17.50 under fuel oil. If we charge the entire cost of a new transformer we put in after the first installation, in one year it would be $14.74, against $17.50, or, roughly, $2.75 net saving in operating cost. Including the metal loss, it is $20.50, against $31.10 for fuel oil, or a net saving of $10.60, or 34 per cent less than fuel oil. While it is reasonable to assume that the fuel oil costs are too high, at the same time it must be remembered that both methods have had the same supervision, but that one lends itself more readily to supervision than the other. It can also be argued that any one attaining greater efficiency with oil should have the personnel available to get still better efficiency with electric melting.

Intelligent Operation is Essential

The accompanying sketch shows the position and general spacing of the units in the melting department. The space occupied by the two electric furnaces is about 20 x 20 ft. The transformer and high-voltage switches are located in a vault outside the main foundry. Attention is drawn to the location of the operating ends of the furnaces and the location of the meters, enabling one operator to take care of two furnaces with a minimum of movement. In fact, it is the writer's opinion that it would be very difficult for one operator to take care of two furnaces if they were not placed with the operating ends together.

There are several features necessary to observe if one is to obtain satisfactory results from this type of furnace. Complete pouring and charging in the minimum time possible are essential. Naturally, the charging is more important than the pouring, for in pouring the furnace does not suffer nearly as rapid a loss of heat as during charging, for in the latter case the door is open and the heat loss is more rapid. We have found it is necessary to add about 1 kw. for every two minutes the furnace is open above the initial five-minute period, in order to regain temperature, other conditions being equal. In order to keep this time down to a minimum, it has been found economical to provide the operator with a helper during the charging period. When ingots or heavy pieces are used it is necessary to withdraw the carbons, but with all lighter material it has been found advantageous to allow the carbons to stay in.

The next item of importance is rocking the furnace. We start rocking at from 5 to 15 kw. input, usually at 10 kw., coming to a maximum at 35 to 40 kw. It has been our experience that failure to rock early enough or efficiently, namely, full rock as quickly as possible, renders it extremely difficult to get the metal hot enough, as well as increasing the power input in proportion.

The next thing is to maintain the proper arc. This

Table I—Summary of Costs per Ton Melted

Electric power, 321 kw. at $0.0259	$8.35
Wages, at 60 cents an hour	2.30
Fuel oil for ladles, 14.9 gal. at 7 cents	1.04
Electrodes, 4½ lb. at 0.22 60/100	1.00
Crucibles, 70—22½ tons	0.29
Linings, at 162 tons per lining	0.39
Patching and supplies	.17
Sub-total	$13.54
Metal loss, 2.4 per cent, at 12 cents per lb	5.76
Semi-total	19.30
Unforeseen: Transformer burnt out	1.20
Grand total	20.50

Table II—Overhead Costs on Melting per Ton Melted

Supervision	.20
Interest on investment	.65
Depreciation (ten years)	1.08
Taxes $3.78 per $100	0.25*
Total	$2.18

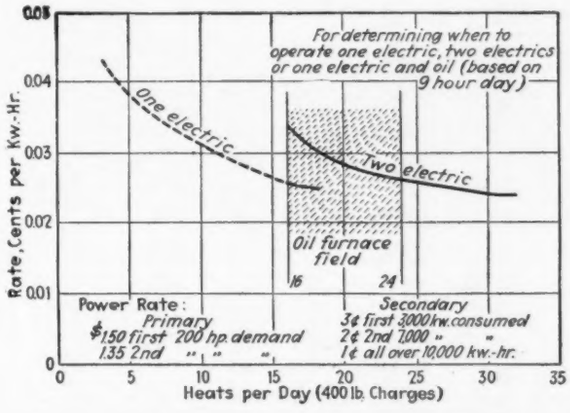
*Taxes at 60 per cent of value.

may be accomplished only by constantly keeping an eye on the meter, as the arc is manually controlled. Failure to do this means loss of time and cold metal. It is practically impossible to get good results from these furnaces by methods which were good enough for oil or coke. Things happen too quickly, and the man operating this furnace must watch his meter or the day's check-up will tell the sad story.

The operator is required to mark the time of starting to charge, time of starting arc, time or kilowatt starting to rock, time arc is off, quantity of metal as well as the type of metal and temperature. With all this writing to do, as well as the pouring, charging, etc., it keeps a man busy if he intends to get out fifteen 400-lb. heats in nine hours. By carefully checking records it is quite easy to determine in the office just where the system is falling down. If the operator is careless in his records it is practically impossible to tell where the fault lies. But because it is possible as well as practical to get accurate records (this being one of the chief assets of the electric furnace) for each day in about fifteen minutes, a complete check-up can be made on the kilowatts per ton and the per cent efficiency for that day.

Another cause of inefficiency, which is usually encountered only when using particularly dirty scrap, is the slag building up in the furnace. While with ingots or clean metal this is negligible, it can under unfavorable circumstances cause almost as much trouble as insufficient rocking. It will also, if allowed to build up, work a severe handicap on the lining as it causes the metal to lay higher in the furnace, throwing more heat on the upper half and allowing the lining to be rapidly melted.

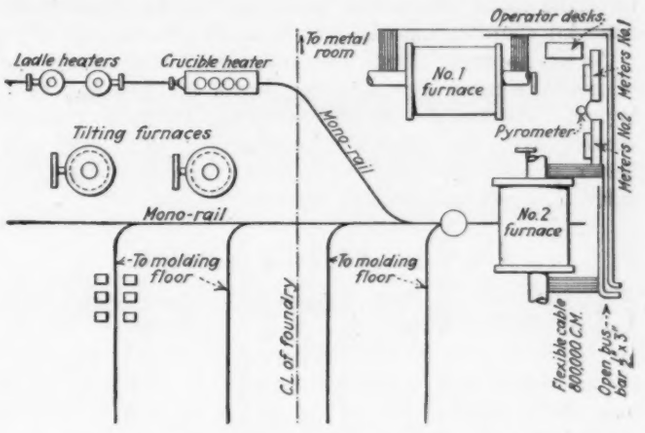
The amount of metal which can be charged at one time varies considerably. All ingots, with a clean furnace, will permit 500 lb. With about half ingots and balance scrap and gates it is not difficult to charge 350 lb. Turnings, skimmings, etc., work best at 300 lb. or less.



Output of Metal, Energy per Ton and Energy Cost per Ton

Copper cable is particularly annoying and 100 lb. in a 300-lb. charge will often cause a short circuit, as it is difficult to keep it from touching both electrodes, and its high conductivity permits a large current.

The maintenance of the furnaces and accessories does not entail any more care than that of oil-fired furnaces, although certain things must be done regularly. Once a week we have a special man oil and grease the moving parts as well as the motors. The present greatest source of expense aside from the linings are the cables. We have not been able to get the results we feel should be obtained. The design is such that it simply seems impossible to keep the cables from breaking near the furnace, where a very narrow bend is located. We get about a year's service from these cables by reversing the ends, but often they cause trouble when they get old through the strands breaking, leaving the remaining



Layout of Furnaces and Molding Floor

good ones greatly overloaded. It seems to the writer that the design could be improved so that these cables would last indefinitely.

By far the most important feature is the linings. In the beginning we experimented with various kinds of linings, but now we use a fire brick material. Contrary to general practice, we do not renew our linings by the number of heats or visual examination, but by the per cent of efficiency of melting. We obtain this per cent efficiency by adopting a set of standards which correspond to the manufacturers' guarantees. These are 300 kw. per ton of composition, 275 kw. per ton of brass and 240 kw. per ton for our own leaded bronzes.

However, each day we calculate the standard kilowatts required for the metal melted that day, allowing 25 kw. extra for Mondays or days after holidays. When the lining reaches a point where conditions are such that fifteen heats (400 lb.) should have been and were not taken out in 9½ hours and, at the same time show an efficiency of 10 per cent above standard, the lining is invariably in such a physical condition as to warrant its renewal. A new lining installed costs us about $65. It is put in and run in with the utmost care, and not by the operator, as he is melting and could not do it properly if he wanted to. An old lining would cost us in power, if allowed to run two weeks, about $20 more for 150 heats, whereas it would give us a saving in linings of only about $14 besides the loss in production.

Initially, we had two 100-kw. transformers. While there is little doubt that these two are sufficient for operating the furnaces, at the same time they permit of much overloading, and it has been our experience that when an operator can speed things up and at the same time not work any harder he will usually do it. As a result, the furnaces often pull 130 kw. and almost always 120 kw. In addition, when melting light scrap, copper or turnings, excessive short circuits often occur, which, in our case, resulted in the breakdown of a transformer right at the busiest season. Considering the slight additional cost of a larger transformer, it surely seemed like a good investment to get a 125 or 150 kw. transformer. So in replacing the burnt out one

we put in a 150 kw. This not only gives us a slightly greater melting speed but eliminates overloading.

In the beginning we had considerable trouble with the remote-control switches, but since they have been properly adjusted they require little attention, except to tighten up the nuts about once a month. They seem to shake loose due to the pounding of the arm as the solenoid slams it in.

As is apparent from the foregoing, our experience with electric arc furnaces for brass melting has been happy. We have reduced our costs, we have a better control over operation and production, our shop is a better place to work in. Taking everything into consideration, we recommend the electric furnace.

Uses for Old Fire Brick

OLD fire brick may be ground into calcined clay which may be mixed with raw or green fire clay in preparing filler to be used in laying fire brick. Machines are on the market which will grind the old fire brick so that the product removed by air separation from the pulverizer will all pass through a 40-mesh sieve. The cost of the product so recovered is estimated by the purchasing and storeroom committee of the N.E.L.A. at one-sixth the cost of new material and represents a handsome saving. Special attention, it says, should be paid to selection of bricks to be pulverized to insure that no unsuitable brick (such as those covered by slag) are used, as they would reduce the refractoriness of the calcined clay.

In addition to the above use a certain proportion of second-hand fire brick may be used for backing in maintenance or new construction work.

Increasing Use of Electric Material Handling

DURING the past year industry as a whole was much benefited by the improvement and increase in the number of applications for handling materials electrically. The removal of the human element has in many cases resulted in astounding increases in plant efficiency, declares the A.I.E.E. committee on general power applications. One example of speeding up production electrically involved a 300-hp., 20-ton locomotive with its 14-ton ingot car which conveys 300 tons hourly from the soaking pit to the mills. This distance averages 325 ft. and is covered in 20 seconds running time. Needless to say, the braking equipment and "dead man control" must be highly efficient to control safely the 4-ton mass of red hot metal.

A number of 12-cu.yd. shovels was placed in service during the past year. Due to the extreme fluctuation of current demand, it was necessary to design special equipment for the drive and control of these shovels. Three motor-generator sets, with the generators all differentially wound, are capable of generating 750 kw. The four motors for the various drives aggregate 650 hp. One of these shovels recently established a new world's record for material handled when it moved 15,497 cu.yd. of overburden in 24 hours.

Electrically operated conveyors are operating successfully in several large pulp mills for handling the sticks from the river to the storage yard and from the yard to the mill. One installation consists of a log stacker, capable of building stacks 60 ft. high, running parallel to a chain conveyor. Another type of installa-

Central Stations Operating at Pressures Over 400 Lb

Arranged According to Boiler Pressure (Courtesy of *Power*)

Station	Location	Operating Company	Size Unit, Kw.	Ultimate Plant Capacity, Kw.	Initial Operation Year	Boiler Pressure Lb. per Sq.In.	Boiler Temp. Deg.	Throttle Pressure Lb. per Sq.In.	Throttle Temp. Deg. F.
Edgar	Weymouth, Mass.	Edison Elec. Illuminating Co. of Boston	†35,000	350,000	1925	1,400	701	1,200	700
South Amboy	South Amboy, N. J.	Jersey Central Power & Light Co.	25,000	270,000	1929	1,400	750	1,250	750
Northeast	Kansas City	Kansas City Light & Power Co.	†45,000	.....	1928	1,400	725	1,200	725
Holland	Holland, N. J.	New Jersey Power & Light Co.	55,000	220,000	1929	1,400	750	1,200	...
Station A	San Francisco, Cal.	Pacific Gas & Electric Co.	50,000	250,000	1930	1,400	750	1,200	750
Lakeside	Milwaukee, Wis.	Wisconsin Electric Power Co.	†37,000	.....	1927	1,300	...	1,200	730
Deepwater	Deepwater, N. J.	American Gas & Electric Co.	53,000	400,000	1929	1,200	725	....	...
State Line	State Line, Ind.	State Line Generating Co.	208,000	1,000,000	1929	800	...	600	730
Twin Branch	Mishawaka, Ind.	American Gas & Electric Co.	40,000	240,000	1925	650	725	600	725
Columbia	Columbia Park, O.	Columbia Power Co.	63,000	480,000	1925	650	725	600	725
Grand Avenue	Kansas City, Mo.	Kansas City Power & Light Co.	10,000	.....	1928	650	740	590	740
Powerton	Pekin, Ill.	Super Power Co. of Illinois	52,500	.....	1928	650	725	...	...
Waukegan	Waukegan, Ill.	Public Service Co. of Northern Ill.	†50,000	500,000	1927	635	...	600	725
Stanton	Pittston, Pa.	American Gas & Electric Co.	50,000	400,000	1927	625	750	600	725
Philo	Philo, Ohio	American Gas & Electric Co.	40,000	240,000	1924	600	700	550	685
Crawford Avenue	Chicago, Ill.	Commonwealth Edison Co.	†104,000	750,000	1925	580	750	550	725
Long Beach	Long Beach, Cal.	Southern California Edison Co.	†90,000	750,000	1928	460	750	400	725
Binghamton	Binghamton, N. Y.	Binghamton Light, Heat & Power Co.	†30,000	85,000	1927	450	725	400	700
Gould Street	Baltimore, Md.	Consolidated Gas, Elec. Lt. & Pwr. Co.	36,000	144,000	1927	450	735	400	715
Lauderdale	Ft. Lauderdale, Fla.	Florida Power & Light Co.	50,000	150,000	1926	450	750	375	700
Mad River	Springfield, O.	Ohio Edison Co.	20,000	60,000	1927	450	705	375	692
Station C	Oakland, Calif.	Pacific Gas & Electric Co.	37,500	175,000	1928	450	730	415	700
Trinidad	Trinidad, Texas	Texas Public Utilities Co.	40,000	160,000	1926	450	750	375	700
Reeves	Norfolk, Va.	Virginia Electric & Power Co.	30,000	.....	1928	450	725	400	700
Avon Park	Avon Park, Fla.	Florida Public Service Co.	15,000	80,000	1928	448	725	400	715
Comal	New Braunfels, Tex.	Comal Power Company	40,000	120,000	1926	430	700	...	...
Hudson Avenue	Brooklyn, N. Y.	Brooklyn Edison Co.	†110,000	750,000	1927	425	725	375	700
Buck	Spencer, N. C.	Duke Power Co.	35,000	70,000	1926	425	700	350	700
Holtwood	Holtwood, Pa.	Pennsylvania Water & Power Co.	10,000	120,000	1925	425	560	350	...
Riverside	Davenport, Iowa	Riverside Power Manufacture	20,000	150,000	1925	425	700	400	700
Richmond	Philadelphia, Pa.	Philadelphia Electric Co.	60,000	720,000	1925	420	705	375	675
Delray No. 3	Detroit, Mich.	Detroit Edison Co.	50,000	300,000	1929	410	706	375	700
Trenton Channel	Trenton, Mich.	Detroit Edison Co.	50,000	300,000	1924	410	706	375	700
Avon	Avon, Ohio	Cleveland Electric Illuminating Co.	35,000	300,000	1926	400	725	375	700
Grand Tower	Grand Tower, Ill.	Central Illinois Public Service Co.	25,000	.....	1923	400	750	360	700
Kalamazoo	Kalamazoo, Mich.	Consumers Power Co.	20,000	.....	1927	400	700	375	692
Morrell Street	Detroit, Mich.	Detroit Public Lighting Commission	20,000	150,000	1927	400	725	...	...
Neches	Beaumont, Tex.	Gulf States Utilities Co.	21,000 35,000	200,000	1926 1928	400	700	375	700
East Peoria	East Peoria, Ill.	Illinois Electric Power Co.	†23,200	116,000	1925	400	700	...	...
Toronto	Toronto, Ohio	Pennsylvania Ohio Power & Light Co.	35,000	280,000	1925	400	725	350	700
Lake Pauline	Quanah, Tex.	West Texas Utilities Co.	15,000	45,000	1928	400	725	375	700

†Station contains units of a different size or for different steam conditions.

tion uses overhead construction and is able to build stacks 100 ft. high with a capacity of 15 to 20 cords an hour. Storage of a large quantity of pulp wood is now possible, greatly eliminating seasonal operation in this industry.

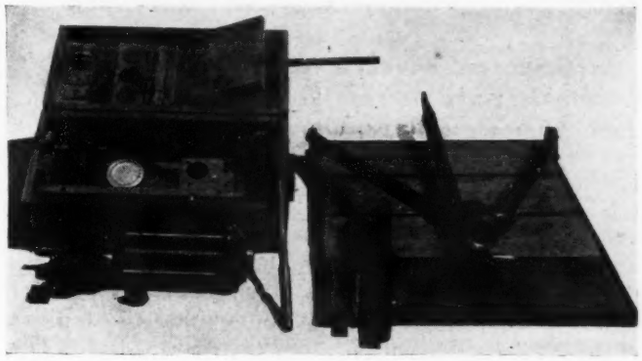
A quite extensive application worthy of note is in the automobile industry. General Motors at three of its plants has made large additions and considerable advance in the preparation and handling of foundry sand. Another dirt conveyor, of interest because of its length, was constructed to carry the dirt produced by the lowering of Denny Hill, Seattle, Wash., to Puget Sound.

A coal conveyor 2½ miles long was put into service by the H. C. Frick Company for transporting coal from the mine to a dock. It is designed to deliver 1,800 tons of coal an hour and is driven by twelve wound-rotor induction motors aggregating 2,400 hp.

Hollow Conductors for 154-Kv. Transmission Line

By T. J. Little
Electrical Engineer, Anaconda Wire & Cable Company, New York

CAREFUL analysis of local conditions and operating requirements led the engineers of Società Meridionale di Electricità of Naples, Italy, to select 154 kv. as the most economical voltage for use on the Pescara to Naples 118-mile transmission line. After all of the economics of the Meridionale problem had been studied it was decided that the conductor best suited for



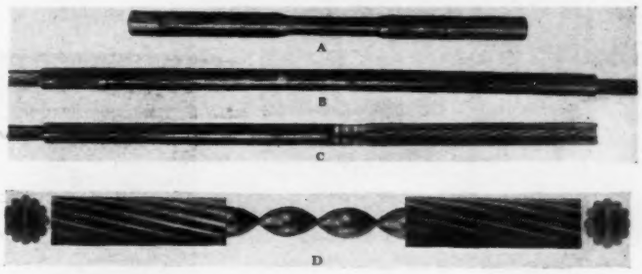
Draw Bench Equipment Used in the Application of the Connectors

operating conditions would be one having an outside diameter of 0.770 in. and an effective area of 300,000 circ.mil. This requirement was met by the Anaconda hollow-conductor cable, whose physical and electrical characteristics are indicated in the accompanying table.

This transmission line runs northeast from Naples over the Apennines to Pescara and is a three-phase system operating at 154 kv. The highest altitude reached is 3,500 ft. above sea level. More than 1,850,000 lb. of Anaconda hollow-conductor cable were required for the complete installation.

Conductance equivalent H.D. copper at 20 deg. C., circ. mil	300,000
Outside diameter of cable, in	0.770
Number of layers	1
Number of H.D. copper wires in cable	12
Diameter of H.D. copper wires, in	0.1537
Dimensions of I-beam core, in	0.461 x 0.040
Area of complete cable, sq.in	0.2411
Weight of complete cable per 1,000 ft., lb	974.0
Minimum breaking strength of cable, lb	12,800
Johnson's elastic limit (average), lb	7,680
Modulus of elasticity, lb. per sq.in	15,000,000
Coefficient of linear expansion, per deg. F	0.0000094

In connecting the conductor seamless drawn tube connectors proved particularly adaptable. The accompanying illustration shows the equipment used in the application of the connectors and of the completed connection. Connectors of this design are guaranteed to develop the full mechanical strength of the cable and will have a cross-sectional area in excess of the conductor, which permits the manufacturer to guarantee full mechanical strength and 100 per cent conductivity in the connection itself.



Seamless Drawn-Tube Connectors Improve Transmission Lines

A—The connector. B—The completed splice.
C—Completed splice with part of the connector cut away and cable removed, showing how the metal in the connector flows around the strands of the cable.
D—Cross-section of conductor used for Pescara-Naples 154-kv. line.

The erection and installation during 1927 of a supervoltage transmission line by the Rhenish-Westphalian Electricity Works, in which hollow-conductor cables manufactured by the Siemens-Schuckert-Werke were used, is another example of the increasing use of hollow-conductor cables for high-voltage power transmission in Europe.

Yearly Tunnel Cleaning Found Necessary

EACH summer it is necessary to clean the inside of tunnels and flumes at the Kern River No. 3 plant of the Southern California Edison Company to remove the accumulation of moss-like growth caused by the larvæ of the caddis fly. The larvæ of the caddis fly are equipped with little hooks which enable them to cling to the side of the waterway. As they cling, they spin minute webs which act as a net for particles of dirt and vegetable matter in the water, from which they extract their food.

With the water shut off from the larger tunnels and flumes workers with special scraping apparatus clear away the accumulation on the wall. In small pipe lines oak brush balls slightly smaller than the pipes, are forced through under pressure of the water and effectively clear out the line.

At the Kern River plant the normal rate of flow is 620 sec.-ft., but when the accumulation caused by the caddis fly larvæ has been built up inside the tunnels and flumes the rate of flow is reduced to 580 sec.-ft., causing a loss in generating capacity of the plant of 2,000 kw.

The caddis fly resembles a miller and is slightly larger than the ordinary house fly and gray in color. Its name is derived from the word "case," as a bony, caselike shield surrounds the larvæ.

The Commercial Job

By JOHN G. LEARNED

Vice-President in Charge of Sales Public Service Company of Northern Illinois

As has been so often and profoundly observed of late years, the problems confronting the electrical utilities are losing their purely technical and engineering characters and are becoming strongly commercial in nature.

In every new direction of development there are always some—men or organizations — that appear to have gone a little faster than the main body of the parade, that are breaking a path. Not doing it spectacularly, with tuckets and fanfares, but naturally and unobtrusively. The ELECTRICAL WORLD *picked on the Public Service Company of Northern Illinois as being one of the central stations in the advance guard of commercial development and persuaded John G. Learned to tell what his company is doing in a commercial way.*

John G. Learned

The story is told not as a claim or implication to excellence of the Public Service Company of Northern Illinois organization, but simply as a recital of what this organization is doing and how it does it. Mr. Learned feels that there are other companies obtaining as good results if not better; these reasons he advanced for not writing the story. But ELECTRICAL WORLD, *conceding his arguments, felt that there were also some companies that did not come in these two classes and might profitably make use of the experience of the Public Service Company of Northern Illinois.*

THE commercial activities of the Public Service Company of Northern Illinois are presented here simply as an exposition of how they are working. There may be other companies doing better; there are undoubtedly others that are doing as well. Nevertheless, just as we are desirous of knowing about the methods and practices of other companies, so are we willing to tell about ours. It is through the accumulated experience of all that progress will be made. This article is written in response to editorial pressure without claim to excellence for the sales organization of the company, either as to its accomplishments or as to the way it does business. But the importance of the commercial activities of the central-station industry, in comparison with its other phases, has only been generally recognized during recent years, and, as is quite natural, several years may elapse before unity of thought concerning the forms and practices of this activity is approximated. Yet unity of thought must be approached before the industry as a whole can make really measurable progress in selling.

The personnel of the sales organization of the Public Service Company of Northern Illinois is not entirely complete, but that does not prevent it from functioning fully. Probably it never will be in such shape that we will be satisfied to stop its expansion. The divisional groups are organized according to their functions, and it is with them that the responsibility of performance rests.

The territory served by the Public Service Company of Northern Illinois begins at Chicago's city limits and extends north to the Wisconsin line, southeast to Indiana, southwest half the width of Illinois and west to the Fox River. The territory comprises approximately 6,000 square miles, in which electric and gas service is supplied to a population of about one million people.

The character of the territory is remarkably diversified. Bordering on the limitis of Chicago is a ring of closely built up suburban home and business centers. Many of the towns and cities of this territory are essentially industrial, but there are also many strictly residential communities, some of which are very rich and exclusive. The northern part of this territory is dotted with highly developed modern farms in an important dairying region extending to the west of them. The south and southwest section of the territory touches the great Middle Western corn belt and is devoted more to general farming.

As a result of continued acquisition of territory and expansion of service, more than 300 communities are now supplied. While executive headquarters are maintained in Chicago, the company attaches especial importance to the maintenance of adequate local facilities for

serving customers. District administrative offices are maintained in eleven suitable locations. Unusually well-equipped service headquarters with modern shops and proper facilities for operating and construction work have been established in three major locations, with additional ones being projected. Thirty-six retail stores supply electric and gas appliances that have passed rigid tests for quality and reliability of performance. Local agents for the exchange of lamps and receiving payments of service statements have been secured in convenient locations throughout the territory.

Lighting Sales

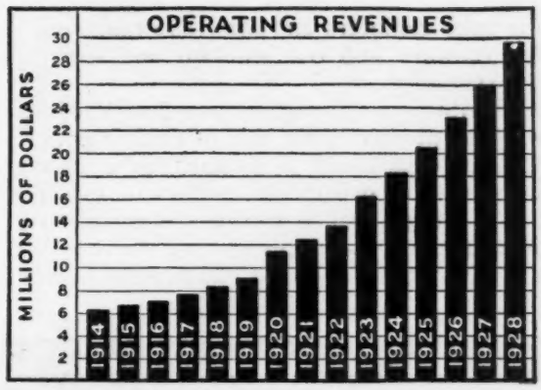
It is recognized that the promotion of the lighting load offers one of the most effective means of obtaining additional revenue from existing investment.

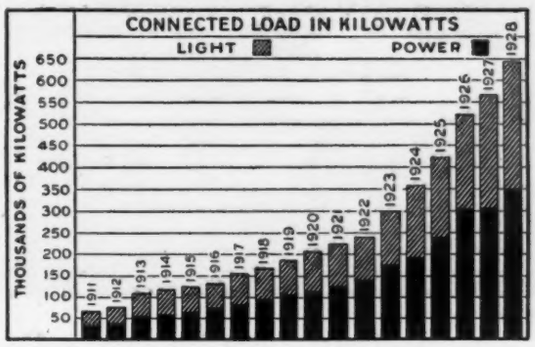
It is an interesting fact that the average kilowatt-hour consumption per commercial customer increased from 1,224 in 1923 to approximately 1,900 in 1928, while in the same period the kilowatt-hour consumption per residential customer increased from 336 to approximately 490; also that the percentage increase in kilowatt-hours sold for street lighting over the previous year grew from 7 per cent in 1923 to 83 per cent in 1928. The average candle-power of street lighting in the territory has grown from 131 in 1922 to over 220 in 1928.

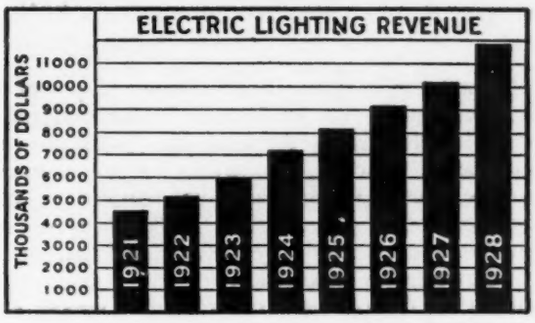
The activities of the lighting sales department, in charge of a manager of lighting sales, are divided into six distinct fields as follows:

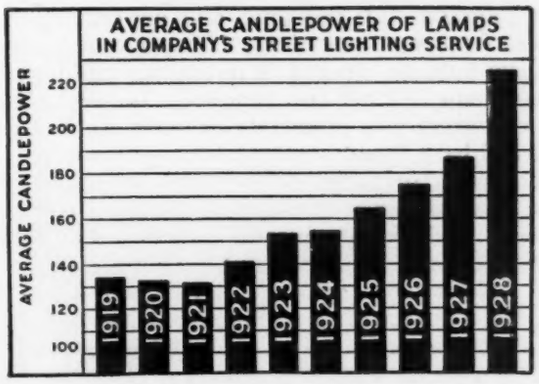
1. The illuminating engineering division, directed by an illuminating engineer, is responsible for the development of new lighting ideas, conducting of experimental lighting tests and for doing research work in lighting development.
2. The architect contact division, directed by a lighting sales engineer, is responsible for keeping in touch with architects for the purpose of making available to them the newest ideas in interior and exterior lighting, signs and wiring, and pointing out to them the importance and necessity of adequate wiring for future lighting requirements and for assisting and encouraging them in incorporating lighting in the architectural design of buildings.
3. The wiring and lighting division, directed by a lighting sales engineer, is responsible for conducting "red seal" activities, convenience outlet campaigns, maintaining contact with electric leagues and conducting model home demonstrations.
4. The street and highway division, directed by a street-lighting engineer, is responsible for the development of engineering plans and sales activities for higher intensity street and highway lighting and for assisting district managers in consummating negotiations for improved street lighting.
5. The lighting service division, directed by an assistant lighting sales engineer, assists the advertising department in developing lighting sales advertising and publicity, assists in conducting lighting schools for company employees and arranges for lighting demonstrations.
6. The district sales division, directed by a lighting sales engineer, assists in conducting lighting engineering work in the company's district offices, assists in sales campaigns and maintains contacts with local architects and contractors.

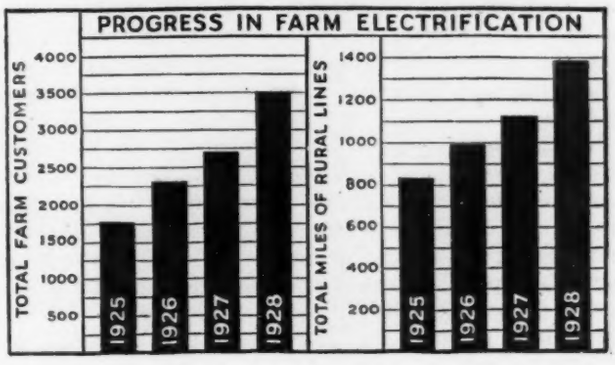
In addition to promoting new ideas for showing that light can be used for decorative effects as well as for utility purposes, the lighting sales department actively promotes aviation lighting, airport lighting and general floodlighting. The present personnel of the department consists of a total of eighteen men—a manager of lighting sales, one illuminating engineer and assistant, three











These Graphs Illustrate the Value of the Comprehensive Sales Organization and Consistent Sales Program of the Public Service Company of Northern Illinois

lighting sales engineers and three assistants, one street-lighting engineer and one assistant and seven district lighting specialists.

The company obtains about one-fourth of its total operating revenue from the sale of electric power. The power sales department is directed by a manager of power sales. The department consists of two men specializing in electric heating applications and electric cooking, one man who promotes the use of electric trucks and seventeen power engineers and assistants, who solicit and represent the company in all classes of power business. Power engineers are located in the outlying districts and for the nearby territory they work out of the general office in Chicago. Contracts for power loads up to 25 hp., except in special cases, are handled by district salesmen located in the districts. All power engineers and assistants are technically trained and have several years of power sales experience.

A Model Farm Serves as a Demonstration Laboratory for Rural Service both Night and Day

During 1928 the company contracted to supply 48,208 hp. of additional power business, represented by 1,474 power contracts. Of this total, 40.7 per cent represents business from new customers, 42.6 per cent represents additional business secured from existing customers and the remaining 16.7 per cent represents business obtained from customers who previously operated isolated power plants and have found it more advantageous to purchase central station service.

The total connected load due to industrial heating installations, including commercial cooking installations of 17,366 kw., increased more than 12 per cent over the connected industrial heating load in 1927. These heating installations consume about 51,500,000 kw.-hr. of electrical energy annually. The industrial heating business is looked upon as the most promising of the newer industrial applications of electricity, and it is estimated that the potential market for this class of service is such that the revenue derived from it in the future may equal that now obtained from other industrial power business.

In the summer of 1925 the company organized an industrial development department, directed by a competent engineer, to assist in stimulating the industrial growth and expansion of the territory served. The communities served by the company are coming more and more to depend on this department for assistance and advice in negotiating with industrial prospects and in the solution of industrial and general development problems. Investigations carried on and reports prepared by this department are not confined to matters pertaining to the sale of gas and electricity, but cover all factors affecting industrial costs, such as marketing, transportation facilities, labor conditions, raw material supply and the availability of desirable factory sites.

During the past four years considerable information has been gathered relating to the economic requirements of miscellaneous industries and to the problems encountered by communities in connection with industrial expansion. The principal activities of the department include:

1. Studies of raw and semi-finished materials available from agricultural, mineral and industrial sources within economical transporting distance of the industrial communities served by the company.
2. Analyses of the labor supply, wage rates, housing conditions, etc., with respect to various types of specific industries which contemplate locating in communities served by the company.
3. Studies of transportation costs of raw materials and finished products to and from proposed plant locations in various communities or areas.
4. Investigations of the present and potential market possibilities of a product, nationally as well as within the area served by the company.
5. Examinations of the financial condition and management of companies which are seeking special inducements.
6. Participation in the planning and operation of definite community industrial development programs.
7. Promotion of reciprocal buying among industries located in the area served.
8. Co-operation with other departments in stimulating the use of the company's service in manufacturing plants.
9. Supplying communities with data helpful in determining the industries which are desirable or suitable.

At present the personnel of the department consists of two full-time men and one part-time man, the intention being to place another man on this work in the near future.

Fifty fairly large industries and a much larger number of smaller industries began operations in the territory served by the company during 1928. These 50 manufacturing establishments have contracted with the company for an electrical energy load of approximately 7,400 hp., and their gas consumption will exceed 1,415,000 cu.ft. per month. These plants employ about 1,950 people, who with their families represent a population of approximately 6,800.

The merchandise sales department is under the direction of a merchandise sales manager, who is responsible for prescribing policies and methods for the district sales deparements to follow and for furnishing advice

and assistance to the dsitrict sales departments in carrying out such policies. He is responsible for the selection of appliances to be marketed, establishment of prices and initiation of sales campaigns. A sales manager or chief salesman, depending upon its size, is located in each district and is directly responsible to the district manager for promoting sales.

District salesmen are assigned definite territories, incorporating approximately 2,200 customers per salesman. They are paid a salary and commission varying from 5 to 10 per cent. The commission schedule is so designed as to encourage the sale of appliances which are the better load builders. Store sales clerks receive a salary and a 2 per cent commission.

In addition to the salary and commission paid district salesmen, each salesman is given a bonus at the end of the fiscal year, provided he obtains the established quota set for his territory. Several times during the course of the year special merchandising activities are promoted which provide additional income for the salesmen.

All employees of the company are encouraged to turn in prospects for merchandise and receive a bonus for those which result in sales. This activity, which is called the "More-and-Better-Business Campaign," creates a spirit of co-operation among the employees, at the same time tending to acquaint them with merchandising policies. A full-time "More-and-Better-Business" representative keeps the employees informed of the sales activities by issuing bulletins, arranging meetings and other appropriate means of maintaining enthusiasm. Meetings are held on an average of once a month with all employees of each district, during which the various sales activities are outlined and inspirational talks given by the district managers, sales managers and other department heads. Through its "More-and-Better-Business Campaign" employees not regularly engaged in sales work during 1928 turned over to the sales department 15,403 prospects for the sale of gas and electric appliances, 5,555 of which resulted in actual sales, amounting to $408,299.66.

The company's total merchandise sales for 1928 amounted to $2,536,767.09. Based upon the total number of residential customers, this represents an average annual merchandise sale of approximately $11.32 per customer. The 47,246 gas and electric appliances sold during the year represent 457 watts for each electric appliance, or a total of 18,900 kw., and an additional gas consumption of 127 cu.ft. per hour for each gas appliance, or a total of 761,256 cu.ft. per hour.

The home service department, working under the supervision of the merchandise sales manager, gave lectures on cooking and various other subjects relating to the home before approximately 275,000 women during 1928, as compared with 10,000 women in 1924, the year in which the department was organized. The services of this department are in constantly growing demand for co-operating in arranging for and participating in community events, such as lectures before women's clubs, domestic science classes and other public and semi-public functions. A thoroughly modern experimental kitchen was opened in the Oak Park headquarters during 1928. All recipes are tested in this kitchen by members of the home service staff before they are published or recommended to customers. In addition, household appliances are tried out to determine their adaptability for various household uses. All work of the department is strictly educational. The home service director is assisted by five girls thoroughly trained in home economics, who act as instructors.

Rural Electrification

An agricultural development department, directed by an agricultural engineer, was established in 1925 for the purpose of making intensive efforts to extend the company's service to as many farmers in the territory as possible. The company is now supplying electricity to more than 3,860 farmer customers and has a well-defined policy for extending service to many more of the 31,000 farms in the territory.

During 1928, in order to encourage a wider use of electricity on the farm and to demonstrate to residents of the city that the comforts of modern utility service can be had in the country, the company established a model farm near Mundelain, Ill. The uses of gas and electric appliances which minimize labor on the farm and add comforts in the home are demonstrated there. Nearly 20,000 people, representing 46 states and eight foreign countries, visited the farm during the five months in 1928 that it was in operation. It is expected that during

Show Local Interest in Each Community by Erecting Attractive Store and Office Buildings

the summer of 1929 the visitors will considerably exceed that number. Farmer group meetings are frequently held at the farm. Farmer organizations from two nearby counties recently held a meeting there which was attended by more than 3,000 farmers. The agricultural engineer is assisted by two men in the general office and he co-operates with the district managers in directing the activities of seven rural salesmen located in the districts. All rural salesmen have had agricultural training and devote their time to assisting farmers in making additional use of our service as well as arranging extensions to additional farms.

Realizing that the farmer will make liberal use of electricity if he can obtain it without being obliged to finance extension of lines, the company on April 1, 1929, inaugurated a new policy of extending its lines to farm customers, making it possible for the farm to secure such service by agreeing to pay minimum bills each month for a period of 50 months equal to one-fiftieth of the cost of the lines and transformers necessary to serve him.

Although during 1928 service was extended to more than 806 new farmer customers, an increase of approximately 30 per cent over the previous year, because of the cordial reception given the new plan under which electricity is brought to the farmers, it is expected that during 1929 the increase in the number of farm customers will surpass previous years.

Sales Training

During 1928 a comprehensive sales training program, under the supervision of a director of sales training, was organized for the employees of the sales organization. Conferences of the sales supervisory staff are held at regular intervals and sales policies, systems, company products, campaigns, sales technique and related subjects are discussed and dramatized. Full opportunity is given to every sales supervisor to take part in the work. The records of these conferences are used as textbook material by the supervisor in conducting weekly conferences of his own immediate staff. Through this program a uniform method is provided for transmitting sales information to the sales people, with the result that they are better trained and equipped to represent the company to its customers.

Municipal Negotiations

The securing of ordinances and street-lighting contracts, and other matters connected with such relations, are handled by the district managers. Any needed assistance is supplied the district managers by the vice-president in charge of sales and the various specialists of the sales organization.

Sales Promotion

A sales promotion department was established in 1927 and has added considerable stimulus to the company's sales activities by assisting in the development of sales programs and sales campaigns. This department studies and analyzes sales statistics, market surveys, prices and general trends of business and assists the advertising department in making advance programs for publicity in behalf of sales.

During 1928 this department assisted in providing effective plans for special sales campaigns to promote volume sales of refrigerators, gas storage water heaters, vacuum cleaners and gas space heaters. The department, as a part of its regular routine duties, prepares sales training manuals which serve as text books in the company's sales training program. The activities of this department will be increasingly valuable in future sales work of the company.

Advertising

The sales organization of the company is supported with appropriate advertising of various forms, such as newspaper, direct-by-mail, billboard, poster and institutional. The company enjoys most friendly relations with the public it is privileged to serve. The character of the company's property is of a standard at all times in keeping with the communities served. The company everlastingly endeavors to render physical and personal service of the highest possible degree. Last, but not least, its personnel, individually and collectively as a team, is supporting the sales organization in promoting a broader use of the services furnished. All of these things are contributing factors toward the elimination of sales resistance and make for increased sales throughout the widespread area served.

Time-Delay Undervoltage Protection

By A. F. Schoemann,
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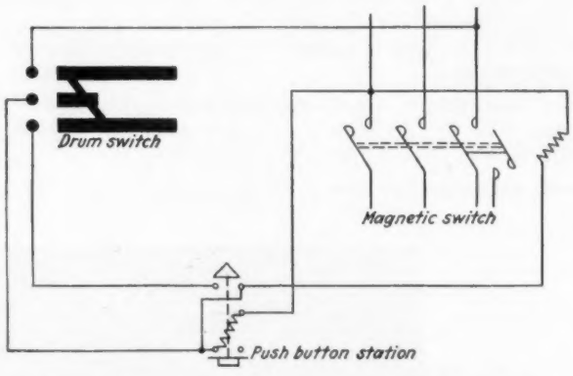
A TIME-DELAY undervoltage push button may be used with wound-rotor induction motors having a magnetic switch in the primary circuit and a drum switch in the secondary circuit. The load on the motor must be such that on the return of primary voltage the peak drawn from the line will not be too great.

Referring to the accompanying diagram, when the



Push-Button, Drum and Magnetic Switches Give Time-Delay Undervoltage Protection

drum switch is moved to the first point the magnetic switch closes and the coil in the push button is energized. Both of these circuits are maintained through the stop contacts of the pushbutton and the drum switch. On momentary dip or failure of voltage the primary contactor drops out. If voltage returns within 1½ seconds this contactor will reclose and the motor will remain in service. It is not necessary to press the start button to start the motor. Pressing the stop button opens the primary contactor and stops the motor at any time except when the drum switch is on the first point.

Transmission Line Performance

Overhead ground wire a definite protection to high-voltage lines in reduction of lightning outages. No direct relation between amount of insulation and performance

FOR two successive years lines without ground wires suffered almost exactly twice as many lightning interruptions as did those provided with such protection, according to a recent report of the overhead systems committee of the Great Lakes Engineering Section, N.E.L.A. As may be observed from the accompanying tables taken from that report, the 1928 lightning interruptions per 100 miles are 8.12 for lines with ground wires and 16.82 for lines without; the figures for 1928 and previous years are 7.43 and 14.5 respectively. The lines concerned in these tabulations are all located in the Great Lakes region and include only those of more than 100 kv. To facilitate comparisons the interruptions are shown in the tables for unit lengths of circuit—100 miles. Interconnecting lines between two companies, portions of which are owned by each, are indicated in two sections, with the interruptions suffered by the line as a whole charged to the two sections according to their respective mileages. It is to be particularly noted that the line interruptions tabulated are not statements of service interruptions, because a specific load may be served by one or more lines.

The average number of interruptions per hundred miles for all of the lines reported was 22.0 for 1928

Table I—Operation Summary—Lines With Ground Wires

Line Characteristics							1928 Performance						Total Performance							
							General				Lightning				General				Lightning	
Line	Configuration	Height to Top Wire in Feet	No. of Ground Wires	Number Insulators	Arc Protection	Length of Line in Miles	Total Interruptions	Hours Interrupted	Interruption per 100 Miles	Hours Interrupted per 100 Miles	Lightning Interruptions	Lightning Interruptions per 100 Miles	Length of Line in Miles (Net)	No. of Years	Total Interruptions	Hours Interrupted	Interruptions per 100 Miles per Year	Hours Interrupted per 100 Miles per Year	Lightning Interruptions	Lightning Interruptions per 100 Miles per Year
31	V	85	1	10	HR	4.8							4.8	2						
59	V	80	1	9	H	25.8							25.8	2						
62	V	80	1	9	H	14							14.0	2						
64	V	80	1	9	H	3.57							3.57	2						
65	V	80	1	9	H	3.57							3.57	2						
70	V	76	1	9	H	4.37							4.37	2						
71	V	76	1	9	H	4.37							4.37	2						
15	V	70	1	9	O			Not	Reported				145.5	1	2	04	1.37	03	1	69
58	V	80	1	9	H	25.8	1	32	3.88	1.23	1	3.88	25.8	2	1	32	1.94	62	1	1.94
16	V	70	1	9	O			Not	Reported				145.5	1	4	07	2.75	05		
54	V	83	2	9	H	18.1							18.1	2	1	18	2.76	49	2	2.76
51	V	80	1	9	H	35.5	2	62	5.63	1.74	1	2.82	35.5	2	2	62	2.82	87	1	1.41
66	V	80	1	9	H	17.43							17.43	2	1	2	2.87	58	1	2.87
63	V	80	1	7	H	14	1	9	7.14	64.3			14.	2	1	9	3.57	32.1		
50	V	80	1	9	H	35.5	3	22	8.45	61	3	8.45	35.5	2	3	22	4.28	31	3	4.28
6	V	71	1	10	F	10.24	1	1	9.75	9.75	1	9.75	10.24	2	1	1.0	4.88	4.88	1	4.88
69	V	80	1	8	F	18.92							18.92	2	2	2	5.29	53	2	5.29
68	V	80	1	9	H	18.92	1	11.3	5.29	59.7			18.92	2	2	19.38	5.29	51.18		
55	V	83	2	9	H	18.1	1	52	5.52	2.85			18.1	2	2	62	5.52	1.70	1	2.76
67	V	80	1	9	H	17.43	1	08	5.74	48	1	5.74	17.43	2	2	28	5.74	87	2	5.74
56	V	80	2	9	H	38.1	2	1.95	5.25	5.12			38.1	2	5	2.23	6.56	2.93	3	3.93
57	V	80	1	9	H	38.1	3	11.83	7.88	31.04	1	2.63	38.1	2	5	12.16	6.56	15.95	3	3.93
4	V	71	1	10	H	27.91	2	21.35	7.17	76.5	1	3.58	27.91	2	4	21.4	7.16	38.35	1	1.79
40	V	70	1	9	H	73.86	3	05	4.07	07	3	4.07	73.86	4	23	18.8	7.78	6.38	17	5.76
19	V	84	1	8	O	11.45	1	4.15	8.73	36.24			11.45	1	1	4.15	8.73	36.24		
41	V	70	1	9	H	73.86	4	13	5.42	18	4	5.42	73.86	4	28	6.49	9.48	2.2	15	5.07
52	V	80	1	9	H	13.3	1	33	7.5	2.51			13.3	2	3	3.60	11.25	13.54	1	3.76
74	V	85	1	10	H	30.79	4	48	13	1.57	1.5	4.87	30.79	1	4	48	13	1.57	1.5	4.87
94	V	85	1	10	H	30.79	4	48	13	1.57	1.5	4.87	30.79	1	4	48	13	1.57	1.5	4.87
32	V	85	1	10	HR								128.5	3	17	3	13.3	2.34	15	11.7
7	V	69	1	10	H	24.74	4	25	16.2	1.09	1	4.04	24.74	2	7	32	14.16	69	1	4.04
18	V	74	1	8	R	31.1	8	3.55	25.7	11.4			31.1	2	9	3.68	14.45	5.94	1	1.6
5	V	69	1	10	F	22.39	4	16	17.9	71	2	8.9	22.39	2	7	21	15.64	46	3	6.68
33	V	85	1	10	HR	77.1	14	84	18.2	1.09	5	6.48	77.1	1	14	84	18.2	1.09	5	6.48
53	V	80	1	9	H	13.3	3	92	22.58	6.89	1	7.5	13.3	2	6	1.27	22.58	4.76	4	15.04
1	V	71	1	10	H	50.35	10	25	19.9	50	6	13.1	50.35	2	25	68	24.80	68	18	18.43
3	V	71	1	10	H	136.79	49	13.09	35.81	9.57	29	21.21	136.79	2	63	13.21	24.85	5.92	45	16.45
26	V	86½	1	8	H	23	8	29.79	34.8	121.5	4	17.4	23.	2	12	29.94	26.1	61.1	8	17.4
2	V	71	1	10	H	118.77	50	5.38	42.19	4.54	20	16.88	118.77	2	63	6.56	26.55	5.53	27	11.39
89	V	69	1	9	F	43.82	12	18.68	27.39	42.65	4	9.13	43.82	1	12	18.68	27.39	42.65	4	9.13
25	V	86½	1	8	R	13.8	4.6	48	32.32	3.48	3.4	31.9	13.8	3	12.2	1.66	29.5	4.0	7.9	19.1
30	V	85	1	10	HH	17.9	9.5	44	53.1	2.46	6	33.5	17.9	2	12.1	18.95	29.65	23.44	8.2	22.75
34	V	85	1	10	HR	51.4	16	4.67	31.1	9.1	5	9.73	51.4	1	16	4.67	31.1	9.1	5	9.73
22	V	84	1	8	O	13.0	4.4	50	33.87	3.85	3.6	27.7	13.	3	12.8	1.68	33.1	4.3	8.1	20.7
20	V	84	1	8	O	29.75	10	7	33.6	2.35			29.75	4	49	3.7	41.2	3.11	39	32.8
17	V	74	1	8	O	27.5	5	83	18.2	3.2	2	7.28	27.5	5	61	12.24	44.4	8.92	51	37.1
27	V	86½	1	8	H	23.8	12.5	59	52.5	2.48	8	33.6	23.8	2	15.9	25.12	67.3	30.67	10.8	22.8
11	V	80	2	10	HH	5.3	.6	1.83	11.32	34.55			*							
73	V	83	1	9	H	55.5	1	23	1.8	42			†							
12	V	80	1	10	HH	53	5	2.17	9.44	4.09	1	1.89	*							
42	V	86½	1	9	H	84.84	9	1	10.61	12	3	3.54	†							
93	T	57½	1	10	H	30.65	6	1.12	19.6	3.82	5	16.3	‡							
8	V							Not	Reported				9.35		Not	Reported				
Totals						1576.38	280.6	150.38	17.7	9.49	128	8.13	1647.44	....	515	248.33	13.70	7.48	318	7.43

F = Flux Control. H = Horn, bottom only. R = Ring, bottom only. HH = Horns, top and bottom. HR = Horn top, ring bottom. V = Vertical. T = Triangular. * = Four months only. † = Six months only. ‡ = Seven months only. ¶ = Ten months only.

Table II—Operation Summary—Lines Without Ground Wires

Line	Line Characteristics: Configuration	Height to Top Wire in Feet	Number Insulators	Arc Protection	Length of Line in Miles	1928 Performance: General: Total Interruptions	Hours Interrupted	Interruptions Per 100 Miles	Hours Interrupted per 100 Miles	1928 Performance: Lightning: Interruptions	Lightning Interruptions Per 100 Miles	Total Performance: Length of Line in Miles (Net)	No. of Years	General: Total Interruptions	Hours Interrupted	Interruptions Per 100 Miles Per Year	Hours Interrupted Per 100 Miles Per Year	Lightning: Interruptions	Lightning Interruptions per 100 Miles per Year
81	V	69	10	...	101.7	5	14.6	4.9	14.3	4	3.96	101.7	2	11	14.6	5.4	14.3	6	2.96
45	V	69	10* / 11	F	63.5	3	8	4.7	1.2	1	1.57	63.5	2	12	44.1	9.5	34.7	5	3.99
82	V	64	10	....	30.8	4	6.2	13	19.9	3	9.74	30.8	2	6	12.7	9.7	41.2	3	4.87
96	T	51	10	....	54.7	6	9	10.9	1.6	3	5.49	54.7	1	6	9	10.9	1.6	3	5.49
46	V	69	10	H	11.45	1.4	3.9	12.2	34.5	.....	.....	11.45	1	1.4	3.9	12.2	34.5	.....	.....
60	V	80	9	H	16.05	1	1	6.2	8	1	6.2	16.05	2	5	1.1	15.6	3.6	5	15.6
61	V	80	9	H	16.05	1	5	6.2	3.1	1	6.2	16.05	2	5	1.2	15.6	3.7	5	15.6
91	T	51	10	....	127.2	30	37.9	23.6	29.8	22	17.3	127.2	2	40	42.1	15.7	16.6	30	11.8
85	T	51	10	H	44.3	10	3.3	22.6	7.4	10	22.6	44.3	2	15	2	16.9	4.5	14	15.8
86	T	51	10	....	.....	.....	.....	.....	.....	.....	.....	82.8	1	16	18.3	19.3	22.1	8	9.7
97	T	51	10	....	25.3	5	9.6	19.8	38.1	4	15.8	25.3	1	5	9.6	19.8	38.1	4	15.8
89	V	69	9	F	.....	.....	.....	.....	.....	.....	.....	43.8	1	9	2.3	20.5	5.3	5	11.4
83	V	64	10	....	43.7	18	7.3	41.3	16.7	11	25.2	43.7	2	19	7.5	21.8	8.6	11	12.6
84	V	64	10	H	33.3	13	8	39	24	13	39	33.3	2	17	5.1	25.5	15.3	15	22.5
92	T	51	10	....	20.6	3	25.4	14.6	123.5	2	9.7	20.6	2	12	26.4	29.1	64.1	10	24.3
90	V	69	9	F	39.7	18	4.2	45.4	10.5	8	20.2	39.7	2	25	5.7	31.5	5.9	14	17.6
80	T	57	10	....	10.8	5	7.5	46.3	69.1	4	37.1	10.8	2	9	24.6	41.7	113.8	5	23.1
21	V	84	8	....	14.41	7	8	48.6	5.9	.....	.....	14.41	3	21	3.3	48.6	7.6	14	3.2
88	T	51	10	....	36.9	23	19.4	62.3	52.4	16	43.4	36.9	2	39.0	22.4	52.8	60.7	23	31.2
87	T	51	10	....	28.9	32	10.6	110.8	36.6	18	62.3	28.9	2	60.5	13.3	105.5	30.9	38	65.8
Total wire without ground..					719.36	185.4	160.9	25.8	22.5	121	16.82	763.16	....	353.4	261	22.07	17.51	218	14.5
with ground.....					1576.38	280.6	150.38	17.7	9.49	128	8.12	1647.44	....	515	248.3	13.70	7.48	318	7.43
Total all lines.....					2295.74	466	311.28	22	13.50	249	10.81	2366.7	....	868.4	509.3	16.61	16.75	536	9.84

T = Triangular. V = Vertical. H = Horn, bottom only. F = Flux Control. *Units added during 1928.

and 16.61 for 1928 and previous years. The total 1928 outage per hundred miles from all companies was 13.5 hours for all lines, or 36.8 minutes per interruptions. These figures are also higher than those for the accumulated records.

As indicated in the cumulative records, it is impossible to establish any definite relation between the amount of insulation on the various lines and their actual performance. However, it is very interesting to note the operation of line No. 45. During 1927 this line was provided with insulator strings of nine $4\frac{3}{4}$-in. units and early in 1928 two additional units were added to the top conductor and one to the middle and bottom conductors. In 1927 this line suffered four lightning interruptions, whereas in 1928 only one was reported. This improvement is felt to be at least partially due to the increased insulation.

In the summary of interruptions classified according to the various causes and also divided by operating systems it is apparent that lightning flashovers constitute the majority of interruptions. But this cause does not predominate nearly as much in the lines equipped with ground wires as on those without. In fact, it would appear that there are several companies whose lightning

Table III—Summary of Interruptions by Causes—All Lines

Company	Total Line Mileage	Overhead Ground Wire	Causes in Per Cent of Total Interruptions: 1928: Troubles on Line: Flashovers Lightning	Flashovers Other Causes	Grounds Except F.O.'s	Short Circuits	Mechanical Failures: Conductors	Ground Wire	Insulators	Supports	Foreign to Line: Incorrect Relaying	Unusual Operating	Unknown and Miscellaneous	Total to Date: Troubles on Line: Flashovers Lightning	Flashovers Other Causes	Grounds Except F.O.s.'	Short Circuits	Mechanical Failures: Conductors	Ground Wire	Insulators	Supports	Foreign to Line: Incorrect Relaying	Unusual Operating	Unknown and Miscellaneous
A	58.3	Yes	17.9	....	....	....	....	....	....	....	35.7	46.4	....	17.9	....	....	....	....	....	....	....	35.7	46.4	....
B	112.80		22.5	....	....	....	....	....	....	....	3.5	66.9	7.1	41	....	2.6	....	....	....	....	....	4.7	47	4.7
C	600.7		47.7	6.8	....	....	....	....	....	....	....	16.0	29.5	47.7	6.8	....	....	....	....	....	....	....	16	29.5
D	151.2		40.5	....	2.6	35.4	....	....	....	....	3.3	18.2	....	53.2	....	3.3	25.7	....	....	....	....	2.2	15.6	....
E	400.54		50	....	1.7	8	....	....	....	1.7	8	12.5	32.5	55.5	3.4	6	3.4	....	....	....	1.1	6	9.7	25.7
F	464.47		39.6	10.4	8.3	....	....	12.5	....	....	....	22.9	6.3	59.7	6.1	9.8	....	....	7.3	....	....	....	13.4	3.7
G	60.6		62.2	4.0	....	....	....	....	....	....	18.7	15.1	....	66	2.7	2.6	....	....	....	....	....	16.4	12.4	....
H	232.56		62.5	6.3	6.3	....	....	....	....	....	18.7	....	6.2	69.8	9.3	4.7	....	....	....	....	....	13.9	....	2.3
Total....	2081.17		46.4	2.1	2.1	5.3	....	1.1	....	7	4.6	20	17.7	63.4	2.5	2.5	4.2	....	6	....	4	3.5	12.1	10.8
J	74.95	No	22.7	....	....	....	....	....	....	....	....	77.3	....	29.8	37.3	....	....	....	....	....	7.5	....	3.4	....
B	14.41		....	....	....	....	....	....	....	....	....	100	....	54.8	....	....	....	....	....	....	....	6.5	29	9.7
C	105.26		68.6	1.7	1.7	....	1.8	....	....	1.2	....	12.2	12.8	64.5	4.8	3.8	7	2.1	....	....	7	3	11.4	11.7
F	32.10		100	....	....	....	....	....	....	....	....	....	....	100	....	....	....	....	....	....	....	....	....	....
Total....	226.72		64.9	1.6	1.6	....	1.7	....	....	1.1	....	17.1	12.0	63.3	5.5	3.2	6	1.7	....	....	9	9	13.2	10.7
Totals all lines....	....	....	53.7	1.9	1.9	3.2	6	6	....	9	2.8	18.9	15.5	63.5	3.7	2.8	2.7	7	3	....	6	2.4	12.5	10.8

Table IV and V—Summary of Interruptions on Double Circuit Lines

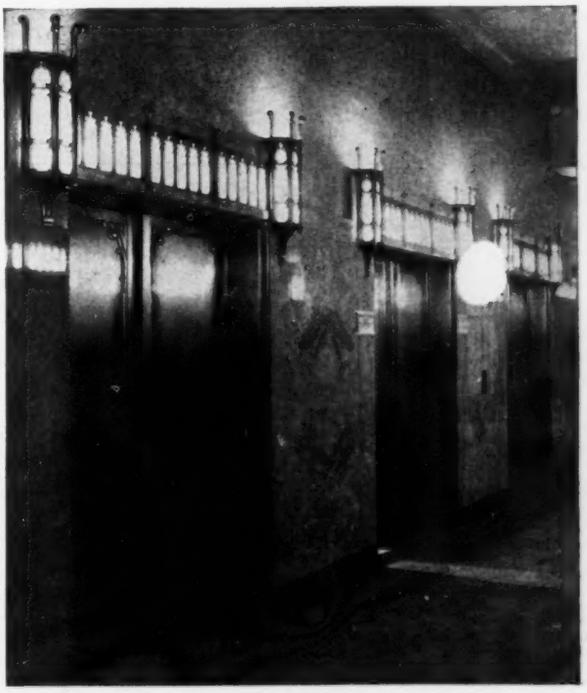
	Lines	Miles on Double Circuit Towers	1928				Total To Date				
			Troubles Interrupting Both Lines	Troubles Interrupting One Line Only	Total Cases of Trouble	Per Cent Troubles Interrupting Both Lines	No. of Years	Troubles Interrupting Both Lines	Troubles Interrupting One Line Only	Total Cases of Touble	Per Cent Troubles Interrupting Both Lines
Interruptions from all causes	4–5–6	30.36	1	6	7	14	2	2	9	11	18
	21–22	10 (App)	2	9.4	11.4	18	3	7	35.4	42.4	16
	40–41	73.86		7	7		4	12	39	51	24
	50–51	35.5	1	4	5	20	2	1	4	5	20
	52–53	13.3	1	3	4	25	2	2	6	8	25
	54–55	18.1		1	1		2		3	3	
	56–57	38.1	1	4	5	20	2	2	7	9	22
	58–59	25.8		1	1		2		1	1	
	60–61	16.05	1	1	2	50	2	3	5	8	37
	62.63	14		1	1		2		1	1	
	66.67	17.43		1	1		2	1	1	2	50
	68–69	18.92		1	1		2		4	4	
	Totals.....	311.42	7	39.4	46.4	15.1		30	115.4	145.4	20.7
Interruptions from all causes except trouble foreign to line	4–5–6	30.36		4	4		2		9	9	
	21–22	10 (App)	2	8.4	10.4	19	3	3	31.8	34.8	9
	40–41	73.86		7	7		4	12	29	41	29
	50–51	35.5	1	4	5	20	2	1	4	5	20
	52–53	13.3		2	2		2	1	5	6	17
	54–55	18.1					2		2	2	
	56–57	38 1	1	3	4	25	2	2	6	8	25
	58–59	25.8					2				
	60–61	16.05	1	1	2	50	2	3	5	8	38
	62–63	14		1	1		2		1	1	
	66–67	17.43		1	1		2	1	1	2	50
	68–69	18.92		1	1		2		4	4	
	Totals.....	311.42	5	32.4	37.4	13.3		23	97.8	120.8	19

troubles are considerably in the minority and which, to improve performance, should look more to better relaying and protection of some sort against troubles originating outside of the lines, rather than directly to additional lightning protective devices.

A special study of all double-circuit lines was made to determine their increased reliability over single-circuit lines. All of these lines are on single towers and are of vertical configuration, with three conductors on each side of the tower. The operation of these lines with all types of trip-outs included is shown. This tabulation gives an idea of the relative value of the double-circuit line as a means of transmitting energy between two given points as compared to a single-circuit line; the two circuits, in all cases, being provided with separate and individual switching equipment. The table indicates that only 15.1 per cent of the total cases of trouble in 1928, or 20.7 per cent of all cases of trouble recorded to date, caused simultaneous trip-outs of both circuits and a total interruption to the connection. In the fifth table the same sort of data is presented as in the fourth, with the exception that it excludes all troubles due to causes outside of the lines themselves. This tabulation gives an idea of the proportion of troubles originating on one circuit which eventually involve the second circuit and cause simultaneous outages of both.

Reports on damage to conductors and insulations caused by flashovers are meager on account of difficulty in securing this class of information. There were about as many cases of damaged porcelain reported for 1928 as for 1927 and there were at least three instances of conductors burned off where arcing rings or horns or equivalent devices were provided. In addition, there were five cases of burnt-off conductors where no arc protection was employed. These eight instances of burnt-down lines represent 5.6 per cent and 5.1 per cent respectively of the total number of flashovers, short circuits and grounds reported on these two types of construction.

Unusual Lighting for Elevator Corridor



ART and utility are equally well served in the lighting of the lobby of the new Public Service Building at Boston, Mass., where the architects and engineers employed color lighting without overhead fixtures to produce a warmth of tone and an agreeable distribution without glare. The lobby is about 110 ft. long, 13 ft. wide and approximately 13 ft. high. The lower sections are finished in amber-colored marble, the upper portions and

ceiling in tinted plaster. The lighting is accomplished by about 200 25-watt clear lamps spaced 6 in. apart on wiring channels behind translucent panels set in grillwork, supplemented by 46 ornamental lanterns, each containing two 50-watt lamps for direct and indirect lighting respectively. Harold Field Kellogg, Boston, was the architect, the electrical installation being by the M. B. Foster Electric Company, Boston.

Electric Steel Melting in Europe

CASTING steel ingots at an electricity consumption of 210 kw.-hr. per ton with an arc furnace charged with liquid metal is shown in the accompanying table of electric furnace characteristics and operating data. These ten furnaces are located in Germany and Italy. The information in the table indicates a general parity of development in the art in Europe with progress in United States.

*Electric Steel Making in Europe**

No. furnaces in plant	4	2	1	1	1	1
Type of furnace	Arc	Arc	Arc	Arc	Induc.	Induc.
Capacity in kva	2,675	1,250	1,800	3,500	350	670
Primary voltage	.....	.....	5,000	5,000	5,000	5,000
Secondary voltage	130	125	133–119–107	146–128–107	130v-1,800A	10
Type of electrode	G.	G.	G.	G.	..	..
Type of lining	B.	A.	B.	B.	A.	B.
Hours operating–day	.....	.....	Cont.	Cont.	15	Cont.
Type of charge	S.C.	S.C.	L.C.	L.C.	S.C.	S.C.
Type of casting	I	C	I	I	C	I
Tons–Mo., furnace	1,800	650	1,800	2,800	82	500
No. charges–Mo.	90	160	200	200	103	85
Average tons, charge	20	4–4.5	10	15	18	6.5–6.8
Kilowatt-hour, ton	680	725	250	210	865	650
Kg. electrode, ton	4.5	5.5	2.5	2.5	.....	.....
Heats, side wall	75	170	1,000	1,000	1,250	.....
Heats, roof	75	170	45–90	45–90	150	200
Time, charging, hours	6.5–8	.....	2.5	2.5	3.5	8

A–acid; C–castings; I–ingots; S.C.–solid charge; B–basic; G–graphite; L.C.–liquid charge.

*From, Western Society of Engineers Hunt Award Paper for 1929 by Delton T. Waby.

Growth of Pulverized Coal Combustion

Four million kilowatts now on pulverized coal basis. Thirty per cent of country output comes from these plants

By F. A. Scheffler
Fuller Lehigh Company, New York

ON MARCH 1, 1929, there were 64 plants with a total capacity of 3,275,000 kw. using pulverized fuel combustion. There were contracts for new plants and additions to existing plants to the amount of 873,000 kw., bringing the present score for pulverized fuel above the 4,000,000 mark. The plants operating in 1926 numbered 37 and, in 1927, there were 47, the corresponding kilowatts of capacity being 2,179,000 and 2,670,000.

The kilowatt-hours produced by plants of this character may be estimated by assuming a 50 per cent load factor. Likewise the fraction of total coal burned in pulverized form in power production may be approximated by assuming 1.5 lb. of coal per kilowatt-hour (as against the 1.76 lb. average for all plants reported by the U. S. Geological Survey). On these assumptions the present status of pulverized coal may be taken as that indicated in the accompanying tabulation.

Present Status of Pulverized Fuel

	1926	1927	1928
Number of plants	37	47	64
Total kilowats capacity	2,179,000	2,670,000	3,275,500
Kilowatt-hours	.....	11,696,550,000	14,344,500,000
Percent of all kw.-hr*	20.0	25.6	30.5
Pulverized coal (tons)*	.....	8,772,511	10,758,375
Per cent of all utility coal*	17.0	20.9	26.0

*Estimated.

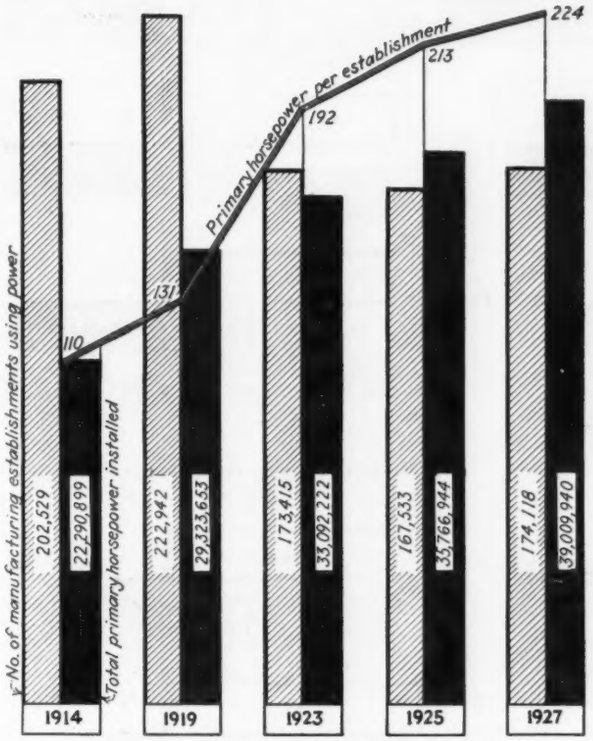
Public Utility Plants in the United States Operated with Pulverized Coal

(To March 1929)

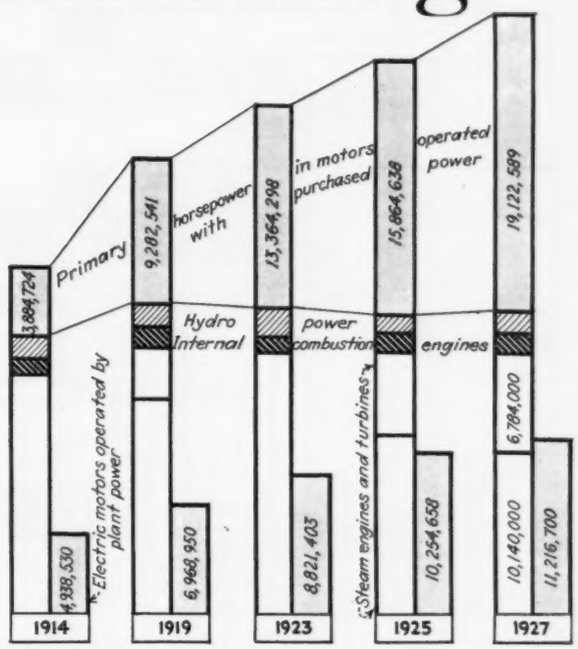
Station	Company	Ky. Capacity Installed
Gorgas Steam Plant	Alabama Power Co	60,000
Union	Binghamton Light, Heat & Power Co	53,000
Parr Shoals	Broad River Power Co. (36,000 kw being installed)	42,500
Chas. R. Huntley	Buffalo General Electric Co (75,000 kw. being installed)	135,000
Lafayette Street	Central Iowa Power & Light Co	6,000
Avon	Cleveland Electric Illuminating Co	140,000
Lake Shore	Cleveland Electric Illuminating Co. (est'mtd.)	70,000
Columbia Power	Columbia Power Co	140,000
Calumet	Commonwealth Edison Co	20,000
Grand Rapids	Commonwealth Power Co	25,000
Goulds	Consolidated Gas & Electric Co. (Baltimore)	72,000
Kalamazoo	Consumers Power Co	20,000
Trinidad	Texas Power & Light Co	50,000
Trenton Channel	Detroit Edison Co	250,000
Brunot Island	Duquesne Light Co	100,000
Colfax	Duquesne Light Co	110,000
Elmira	Elmira Water & Light Co	15,000
Hartford	Hartford Electric Co. (mercury boiler)	7,500
	Harrisburg Light & Power Co	5,000
East Peoria	Illinois Electric Power Co	46,000
Northeast	Kansas City Power & Light Co	30,000
Dubuque, Iowa	Interstate Power Co	12,000
Sixth Street	Iowa Railway & Light Co	5,000
Nortonville	Kentucky Light & Power Co	6,000
Lockport, N. Y.	Lockport Light, Heat & Power Co	5,000
Glenwood	Long Island Lighting Co	25,000
Susquehanna River	Metropolitan Edison Co	30,000
Lakeside	Milwaukee Electric Railway & Light Co	137,000
Oneida Street	Milwaukee Electric Railway & Light Co	10,000
Montaup	Montaup Electric Company	80,000
South Street	Narragansett Electric Company	90,000
First Avenue	Nashville Light & Power Co	20,000
Market Street	New Orleans Public Service Co	108,000

Station	Company	Kw. Capacity Installed
East River	New York Edison Co. (150,000 kw. being installed)	120,000
Rochester	Northeast Electric Co	8,000
Island	Northern States Power Co	25,000
Mitchell, S. D.	Northwestern Public Service Co	10,000
Mahoningside	Ohio River Public Service	25,000
Toronto	Ohio River Edison Co	132,000
Horseshoe Lake	Oklahoma Gas & Electric Co	60,000
Pine Grove	Pa. Power & Light Co. (anthracite coal)	55,000
Holtwood	Pa. Water & Power Co	30,000
Valmont	Public Service of Colorado	45,000
Western Avenue	Puget Sound Power & Light Co	30,000
Far Rockaway	Queensboro Gas & Electric Co	37,000
Rochester–Station 3	Rochester Gas & Electric Co. (estimated)	10,000
Lawn Street	Rochester Gas & Electric Co	10,000
Riverside	Savannah Electric & Power Co	15,000
Comal	San Antonio Public Service Co	60,000
Big Sioux	Sioux City Gas & Electric Co	25,000
Buck, Salisbury, N.C.	Southern Power Co. (standby)	70,000
McAllister	Southwest Power Co	8,500
Powerton	Super Power Co. of Illinois (50,000 kw. installed)	50,000
Sherman Creek	United Electric Light & Power Co. (estimated)	10,000
Eddy Street	United Railways	20,000
Ashley Street	Union Electric Light & Power Co	122,000
Cahokia	Union Electric Light & Power Co	235,000
Narrows	Virginia Railway	40,000
Springdale	West Penn Power Co	30,000
San Angelo	West Texas Utilities	5,000
Laramie	Western Public Service Co	8,000
Aurora	Western United Gas & Electric Co	10,000
Appleton	Wisconsin Traction, Light & Power Co	25,000
Bayside Station, Green Bay, Wis	Wisconsin Public Service Co	20,000
Total		3,275,500

Electrification *of Industries* Rapidly Increasing

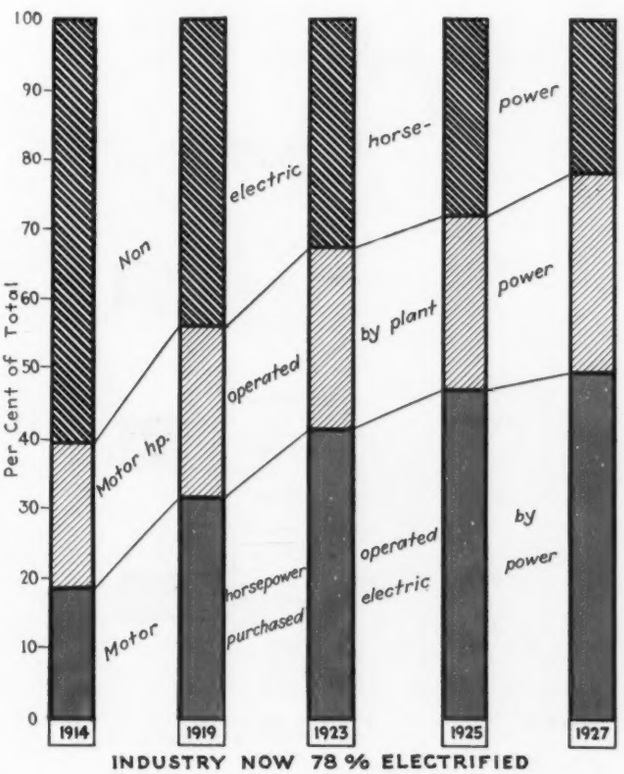


MANUFACTURING ESTABLISHMENTS ARE FEWER AND LARGER

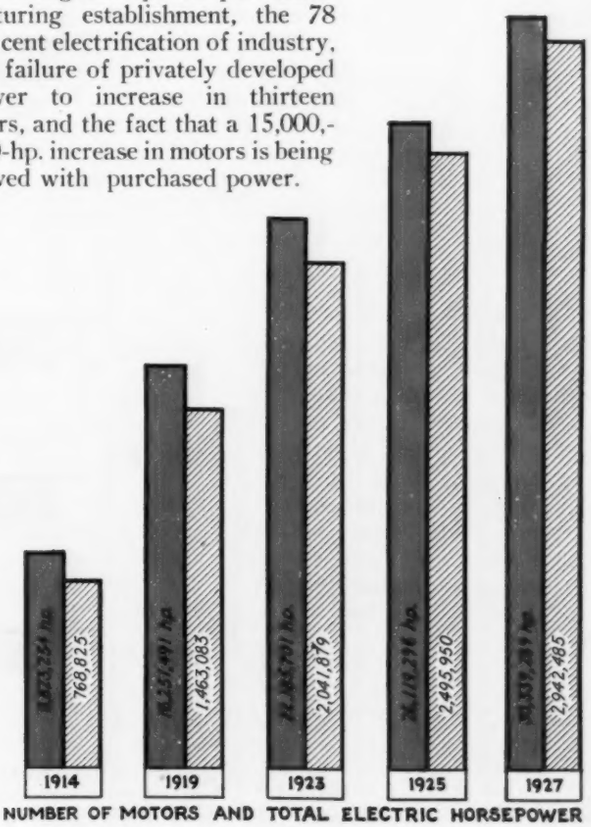


PURCHASED ENERGY GAINS STEADILY

ATTENTION is called to the rising horsepower per manufacturing establishment, the 78 per cent electrification of industry, the failure of privately developed power to increase in thirteen years, and the fact that a 15,000,000-hp. increase in motors is being served with purchased power.

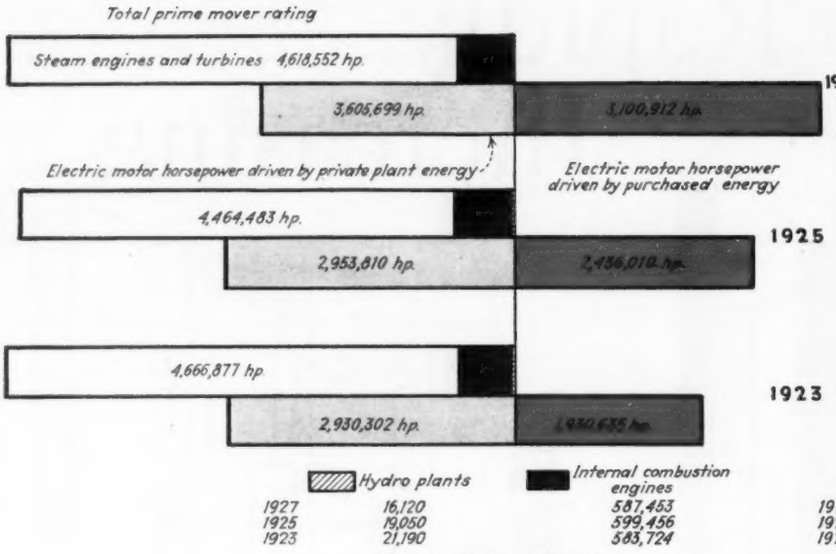


INDUSTRY NOW 78 % ELECTRIFIED

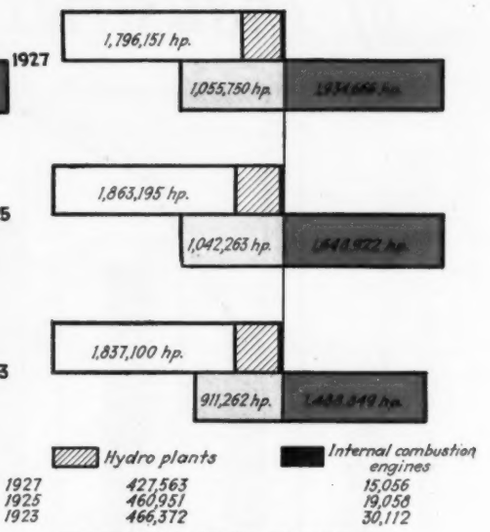


NUMBER OF MOTORS AND TOTAL ELECTRIC HORSEPOWER

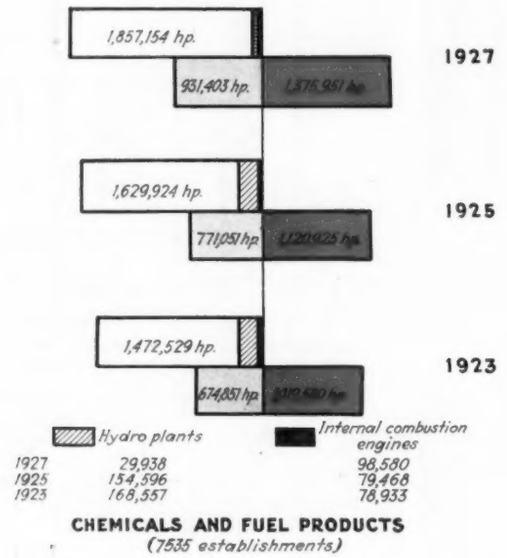
THE TRENDS *in*



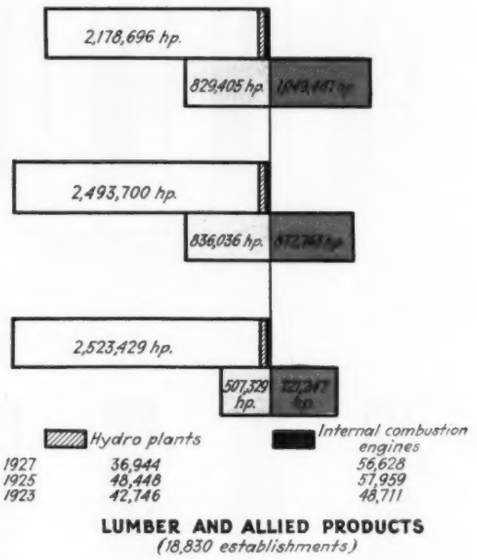
IRON AND STEEL PRODUCTS
(6,189 establishments)



TEXTILES AND THEIR PRODUCTS
(24,873 establishments)

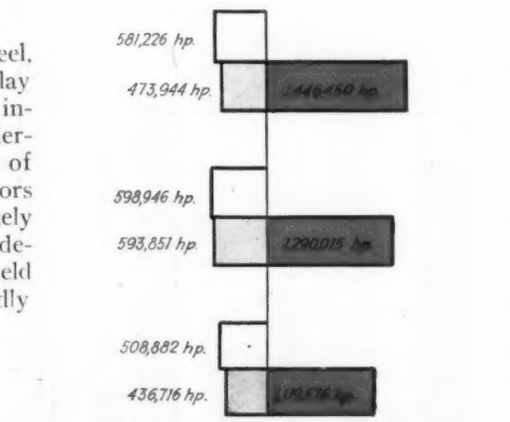


CHEMICALS AND FUEL PRODUCTS
(7535 establishments)

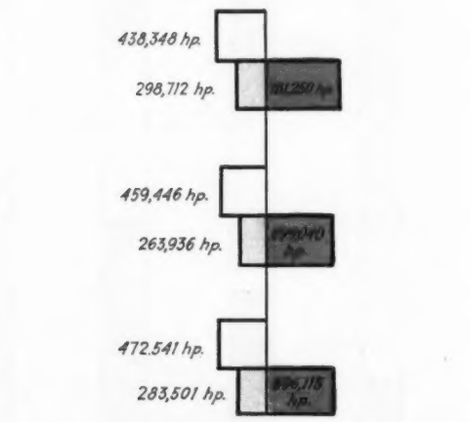


LUMBER AND ALLIED PRODUCTS
(18,830 establishments)

THE iron and steel, food, and stone, clay and glass products industries show considerable increase in use of purchased power. Motors operated from privately developed power have decreased in the steel field but increased markedly in the paper industry.

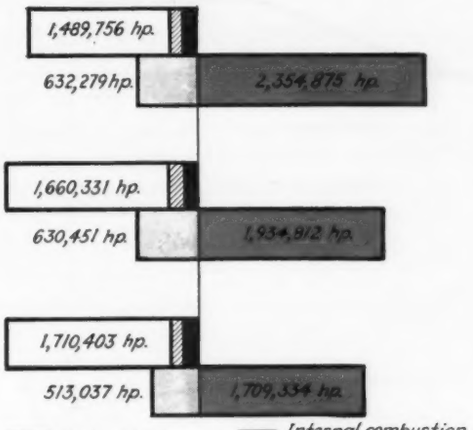


TRANSPORTATION EQUIPMENT, AIR, LAND, WATER
(2,484 establishments)



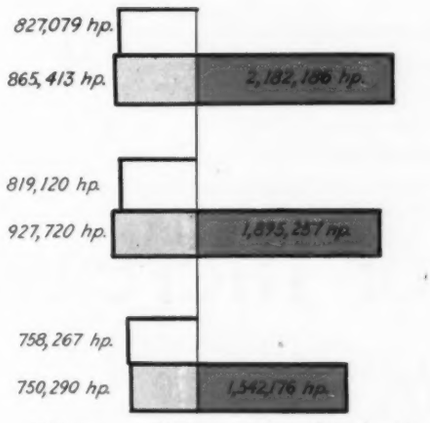
METALS AND METAL PRODUCTS OTHER THAN IRON AND STEEL
(5,254 establishments)

Groups of Industries



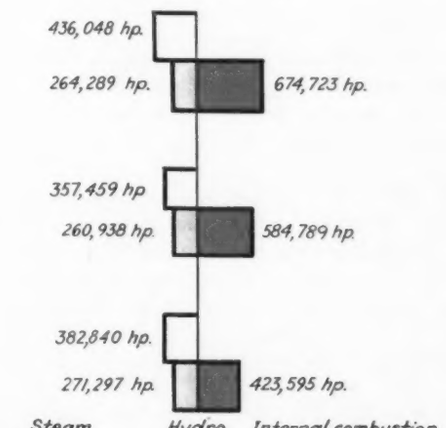
	Hydro plants	Internal combustion engines
1927	104,373	185,969
1925	169,392	177,417
1923	120,912	182,386

FOOD AND KINDRED PRODUCTS
(46,564 establishments)



	Steam	Hydro	Internal combustion
1927	747,475	20,354	59,250
1925	733,192	22,166	63,762
1923	662,559	26,522	69,186

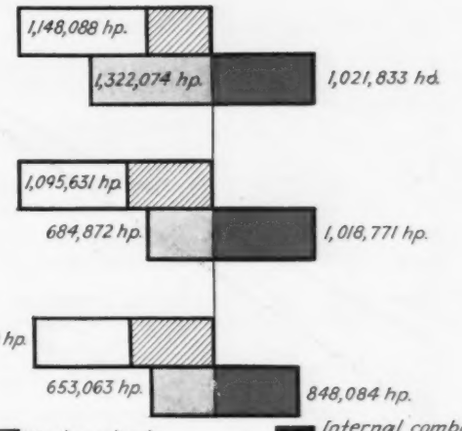
MACHINERY NOT INCLUDING TRANSPORTATION EQUIPMENT
(11,758 establishments)



	Steam	Hydro	Internal combustion
1927	429,091	482	6,525
1925	352,604	32	4,823
1923	359,068	88	23,684

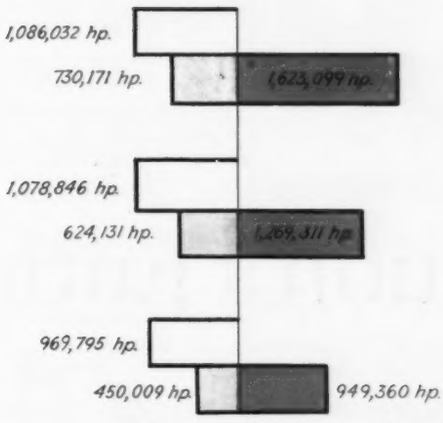
RAILROAD REPAIR SHOPS
(2,016 establishments)

1927
1925
1923



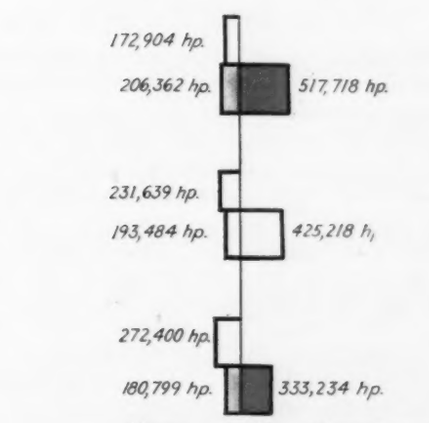
	Hydro plants	Internal combustion engines
1927	901,663	11,397
1925	934,372	12,020
1923	886,447	15,186

PAPER PRINTING AND PUBLISHING
(25,013 establishments)



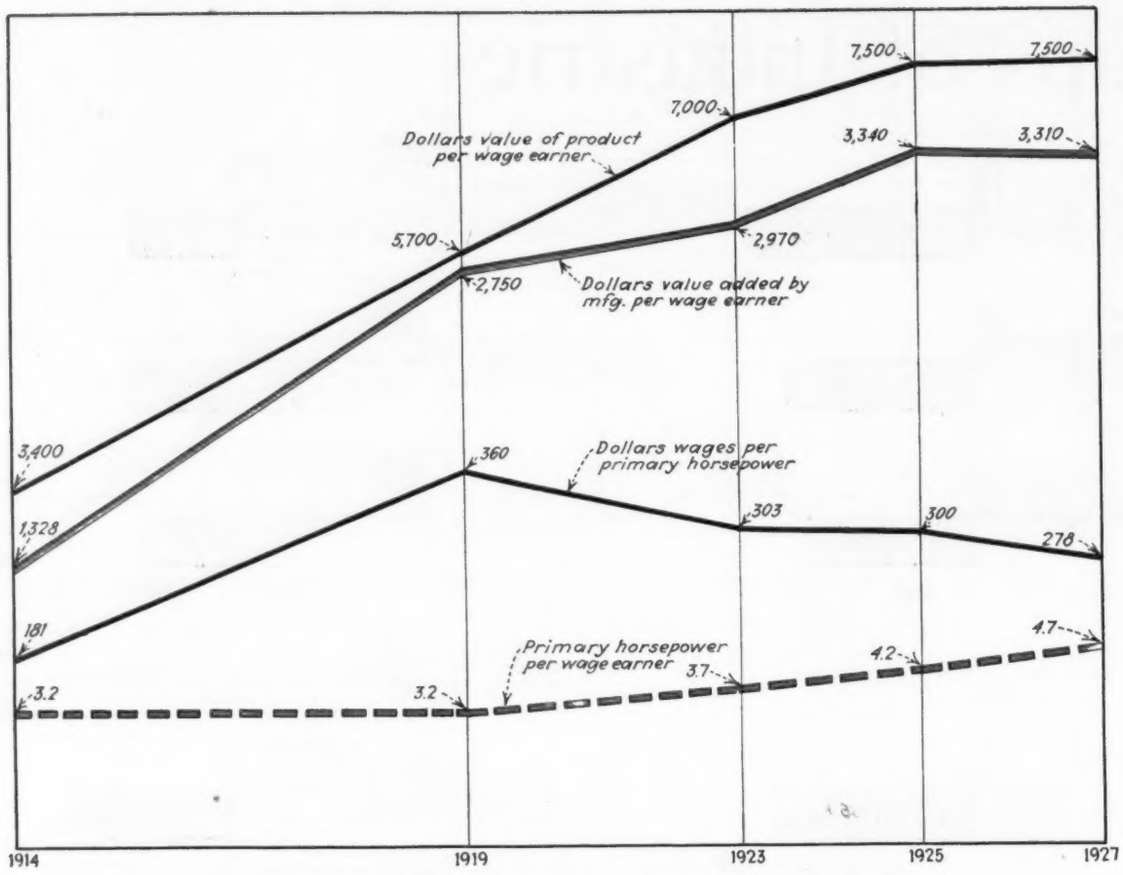
	Steam	Hydro	Internal combustion
1927	954,945	29,637	101,450
1925	937,914	29,096	111,836
1923	847,179	30,582	92,034

STONE, CLAY AND GLASS PRODUCTS
(7,996 establishments)



	Steam	Hydro	Internal combustion
1927	169,152	3,415	337
1925	228,104	3,241	294
1923	257,035	6,506	8,859

RUBBER PRODUCTS
(495 establishments)



ECONOMIC RATIOS SHOW WORTH OF POWER IN INDUSTRY

Nation's Entire Motor Increase

of 15,000,000 Hp.

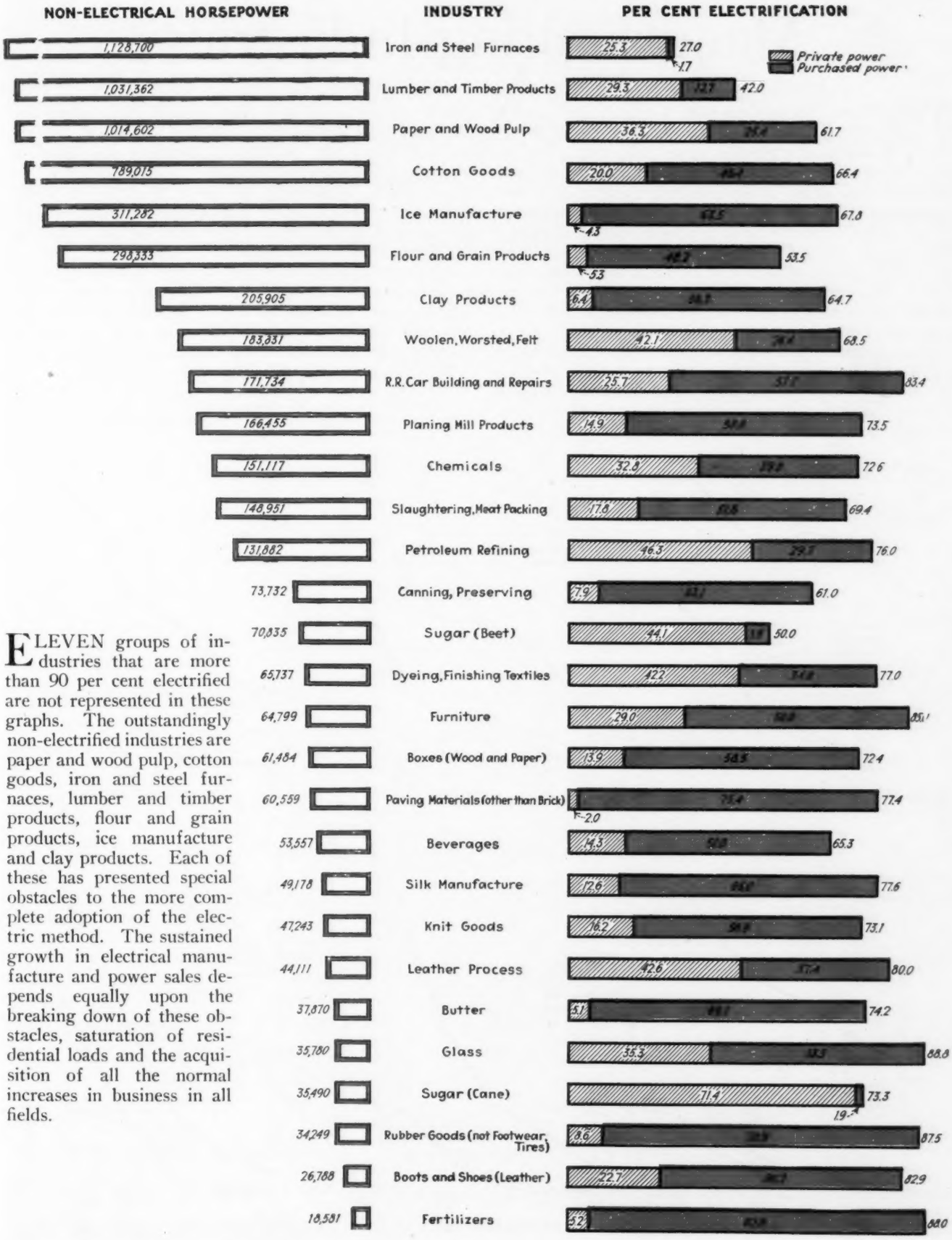
on Purchased Power

THE stability and tranquility of the manufacturing industry of the United States are strikingly portrayed by census data just released. Mere fractions of a per cent change have taken place in two years in the number of wage earners, the total wages, the value of materials, the total cost of purchased power and the total value of the products. The encouraging message to the electrical industry has been the increase in horsepower applied and kilowatt-hours consumed per wage earner. The challenge to greater efforts in load building and apparatus sales resides in the availability for electrification of some 8,500,000 non-electrical horsepower.

Industry is now 78 per cent electrified; 50 per cent of its work is done with purchased power, 28 per cent by motors served from its private power plants. Virtually the entire increase in the nation's industrial motors of 15,000,000 hp. has been connected to electric light and power companies' circuits. A slight decrease is noted in the total horsepower of prime movers in manufacturing plants, but this remains practically stationary at its 1919 value of 20,000,000 hp.

The vigorous drives of central stations and manufacturers have brought several industries to the point where better than 90 per cent of their total rated capacity of motors is driven by purchased power. But even these industries still have a large amount of non-electrical horsepower, as follows: Steel works and rolling mills, 423,148; automobiles and bodies, 90,548; shipbuilding, 29,245; cement, 28,000; rubber tires and tubes, 17,775; foundries and machine shops, 16,827; ice cream, 15,067; brass, bronze and copper products, 13,371; bread and baking, 10,416, and printing and publishing, 8,033. These industries afford one-tenth of the nation's unelectrified market.

Many Industries Remain Partially Electrified



ELEVEN groups of industries that are more than 90 per cent electrified are not represented in these graphs. The outstandingly non-electrified industries are paper and wood pulp, cotton goods, iron and steel furnaces, lumber and timber products, flour and grain products, ice manufacture and clay products. Each of these has presented special obstacles to the more complete adoption of the electric method. The sustained growth in electrical manufacture and power sales depends equally upon the breaking down of these obstacles, saturation of residential loads and the acquisition of all the normal increases in business in all fields.

ELECTRICAL MARKET

Among the

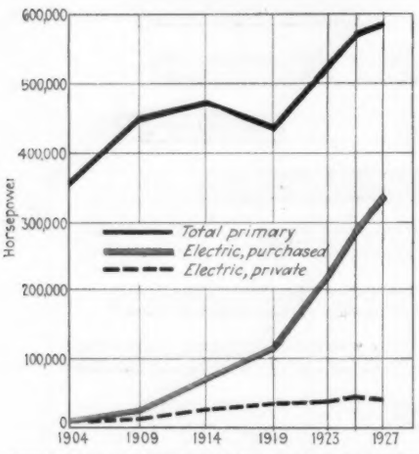
Manufacturing Industries*

THE United States Census of Manufactures reports data on American industry of great value to the electrical manufacturing and power industry. Among the items tabulated are those dealing with the total power utilization, the steam power installed, the amount of privately generated power applied electrically and the amount of horsepower operated with purchased electrical energy. This is reported for more than two hundred industries in sixteen main groups. The trend in 24 of the more significant industries is indicated by the set of curves below, constituting an extension of a similar set published two years ago.

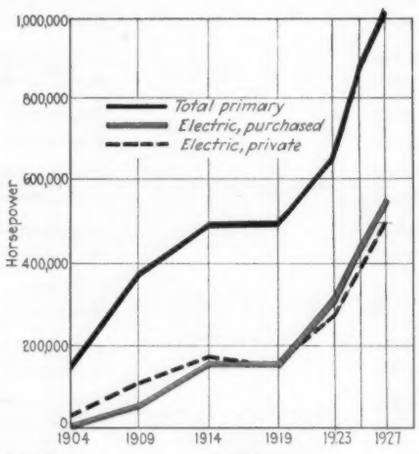
All industries are steadily increasing their use of power and the trend is very distinctly toward a greater adoption of electrical power application. But from an electrical market standpoint there are some very significant differences between the various industries in their use of power. Some are close to full electrification, others are distinctly backward from an electrical viewpoint. There are still found the obstacles to complete electrification which power engineers have had to controvert for years. Even making allowances for these obstacles, it seems that neither the electrical apparatus manufacturer nor the power sales engineer has organized his sales attack in the light of the industrial facts.

This authentic statistical information should dispel any illusion that saturation is near. On the contrary, properly interpreted, it serves as a powerful stimulant to concerted, direct attack on the backward industries. There are still excellent markets and the business situation is such as to justify and encourage exploitation.

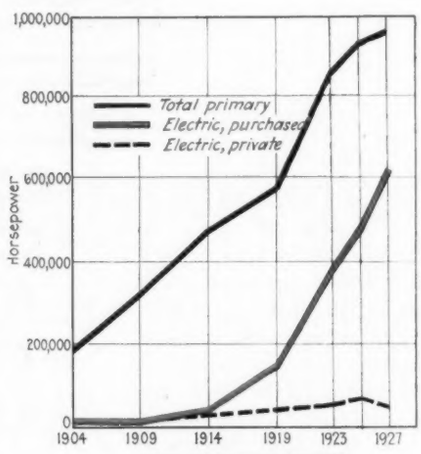
**Where changes in the census classification have been made industries have been grouped to show comparable data for successive years.*



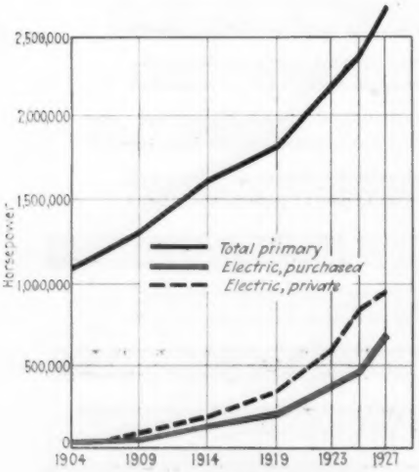
BRICK, TILE, POTTERY AND OTHER CLAY PRODUCTS



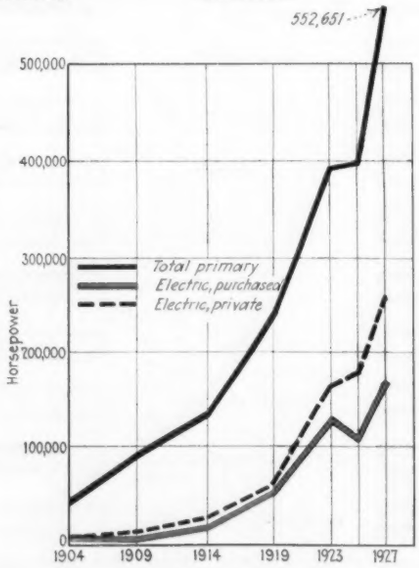
CEMENT



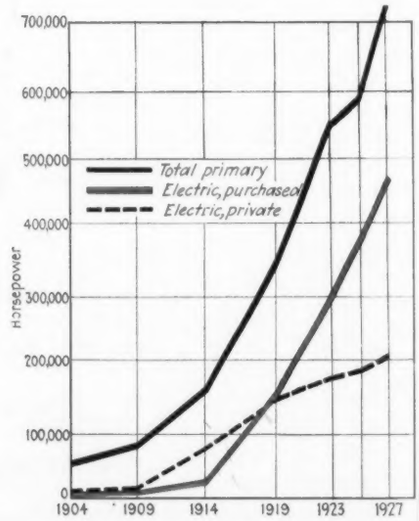
ICE-MANUFACTURE



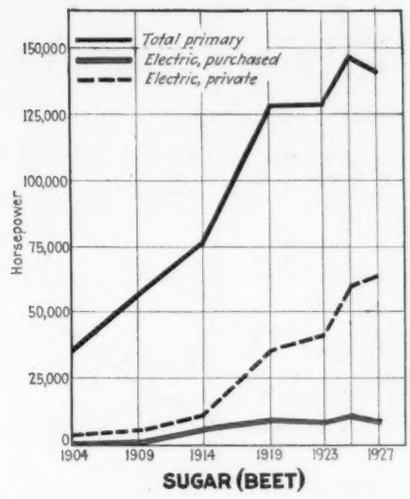
PAPER AND WOOD PULP



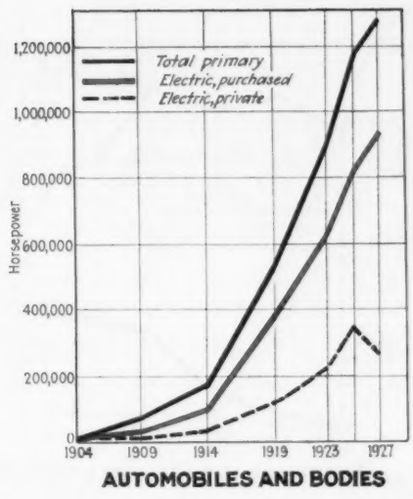
PETROLEUM REFINING



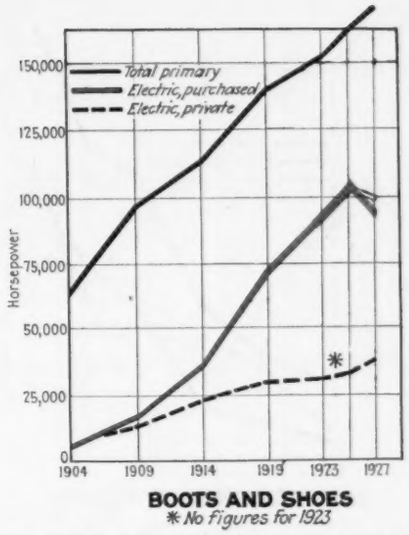
RUBBER PRODUCTS, INCLUDING TIRES



SUGAR (BEET)



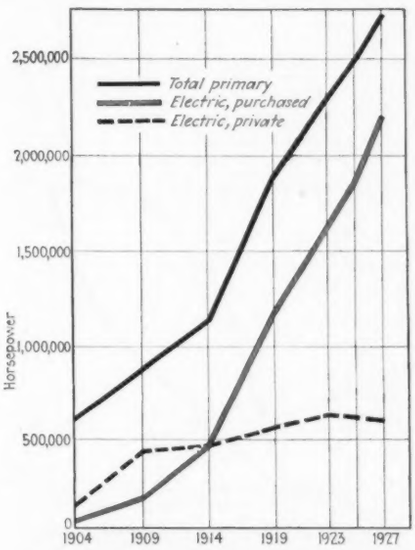
AUTOMOBILES AND BODIES



BOOTS AND SHOES

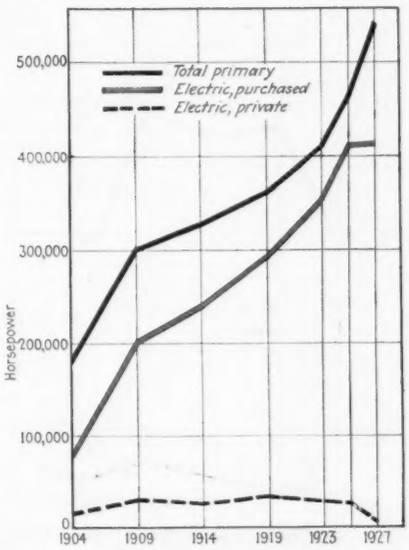
* No figures for 1923

Private powers conspicuous in beet sugar industry but purchased power steps way ahead in automobile and shoe industries.

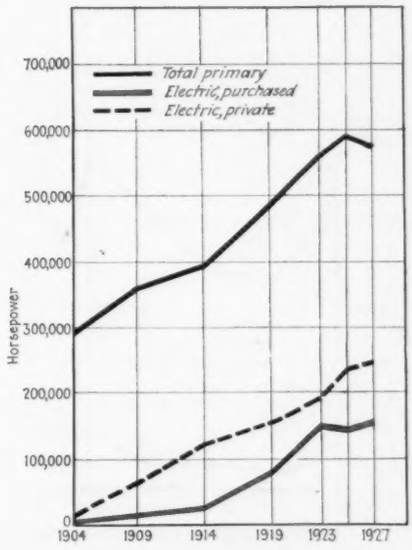


FOUNDRY AND MACHINE SHOP PRODUCTS

* No figures for 1923

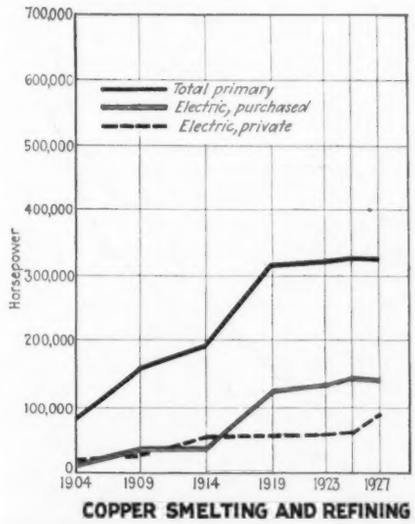


PRINTING AND PUBLISHING

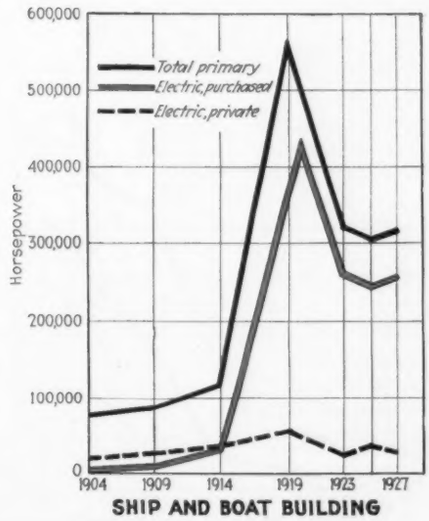


WOOLEN, WORSTED AND FELT GOODS AND WOOL HATS

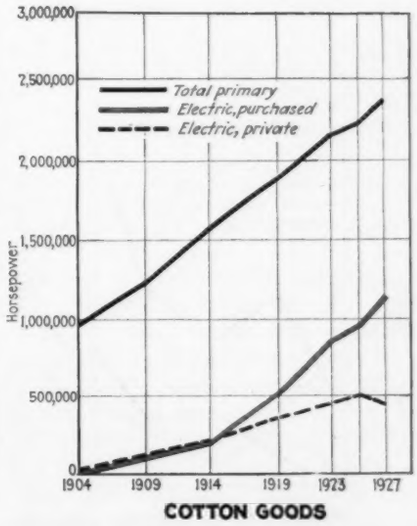
Use of private power dropped below purchased power in foundry and machine shops since 1914. Printing and publishing favorable to purchased energy. Race between two sources in woolen and worsted industries.



COPPER SMELTING AND REFINING

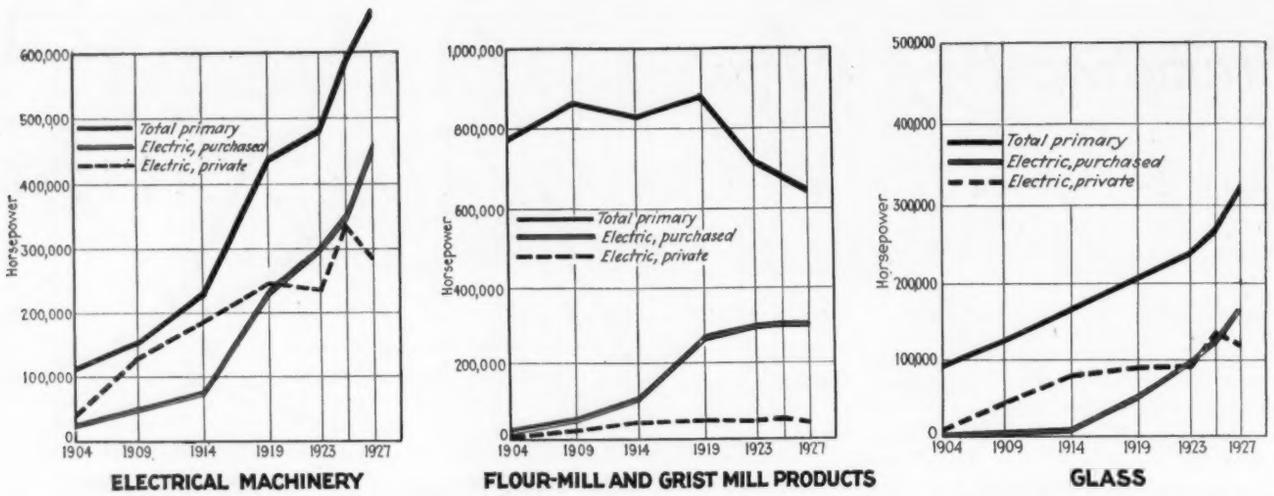


SHIP AND BOAT BUILDING

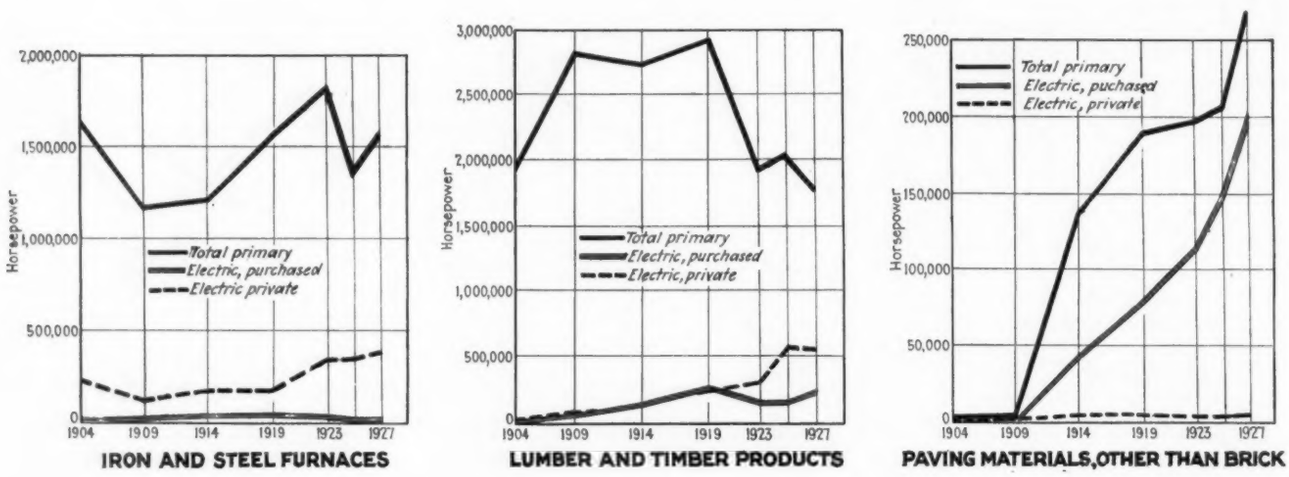


COTTON GOODS

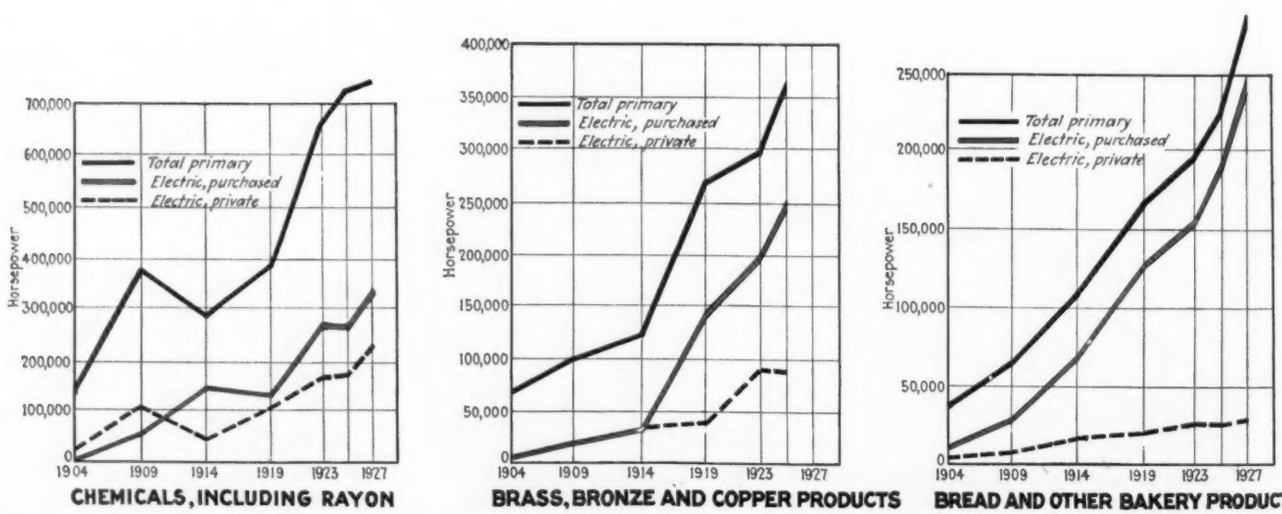
Purchased power took lead in copper smelting and cotton goods industries since 1914. Private power small in shipbuilding.



Electric machinery and glass industries are getting away from private generation of power. Flour mills have favored purchased power for years.



Iron and steel furnaces and lumber and timber industry use private power chiefly, but this source is insignificant in paving material field.



Neck and neck race between sources of power in chemical field. Non-ferrous and baking industries largely favor purchase of power.

Handling Problems of
Interconnected Operation

Methods used in regulating system frequency, control of power and wattless flow, metering, relaying, communication, reserve capacity and station loading

By G. M. KEENAN and E. W. MIDDLETON

Chief System Operator and Engineer, System Operating Department, Respectively
Pennsylvania Power & Light Company, Hazleton, Pa.

WHEN two or more individual systems are interconnected certain problems arise which either do not exist on a system operating independently of other systems or which must be solved in a different manner. These problems include frequency regulation of the interconnected systems, the proper control of the flow of power and wattless over the interconnecting lines, metering, relaying, communication, reserve capacity, station loading and system operation.

The Pennsylvania Power & Light Company operates normally interconnected with three other systems which will be designated as systems A, B and C. This arrangement forms a straight interconnection with one system and loop interconnection with the two other systems.

Although such an interconnected system is apparently complicated to operate, actually the complication has not been at all serious, due in large measure to the splendid co-operation given by all the companies concerned.

Each company has its own system operating department. In order properly to control the power interchanged between the various companies there must be close co-operation and some means of rapid communication between the various system operating departments. Also, there must be a mutually agreed-upon plan of operation.

By mutual agreement with companies B and C the scheduling of generating capacity and the handling of the distribution of load between generating stations and interconnections of these three systems is delegated to the Hazleton system operator of the Pennsylvania Power & Light Company. This work is handled through the system operating branch of the respective companies.

Load Scheduling.—Load specialists in the Pennsylvania Power & Light Company system operating office after consultation with the two other companies prepare daily load schedules showing the number of generators and the number of active and banked boilers each station shall operate and also the average and peak load that each station shall carry. This schedule is arranged so that the combined cost of operation on the three systems will be a minimum. The schedule provides the system operator on duty with the most economical distribution of load between systems and generating stations. In addition a standard practice instruction outlines when and how rapidly each station shall pick up or drop load.

Sufficient reserve capacity is operated on the interconnected system to carry the predicted load in case of loss of the largest unit, whether this be a turbo-generator or an interconnecting transmission line. Each system provides a percentage of the total system reserve in proportion to the relation between its load and the combined system load.

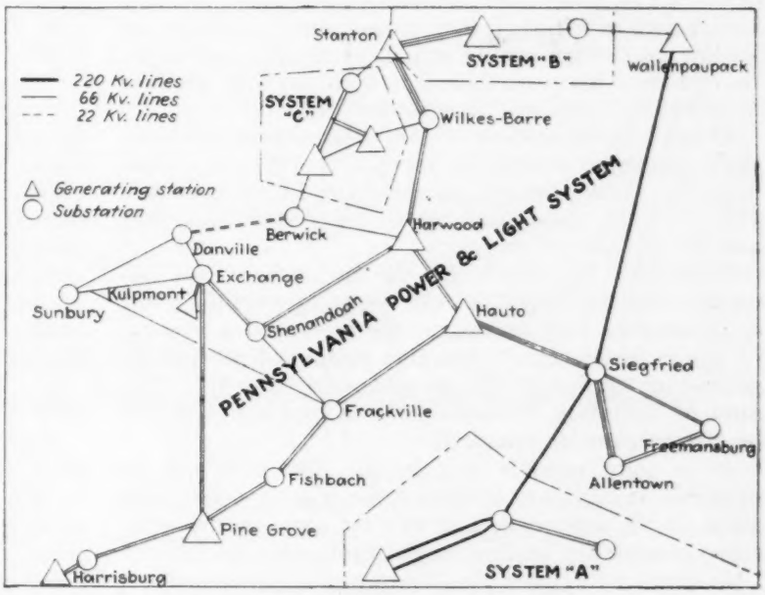


Fig. 1—Four Systems Involved in Interconnection Discussed

A one-line diagram shows the interconnections. The total generating capacity involved is approximately 480,000 kw. and includes eighteen generating stations ranging from 2,000 kw. to 85,000 kw. capacity. With system A there is only one connecting tie line, which operates at 220 kv. With system B ties are made at two generating stations, one of which is jointly owned. The lines of both companies are connected to 66 kv. buses at this station and these buses are operated normally tied together. At the other generating station a 66-kv. line from system B is connected to the P. P. & L. Co. system through a double transformation, 66 kv. to 11 kv. and 11 kv. to 220 kv. There are three 66-kv. tie lines with system C without any transformation at either end.

The interchange of power over the interconnection with company A is so scheduled that both companies receive the maximum benefit from this tie. The time at which power shall flow to one company or the other and the amount of this flow is decided by mutual agreement between the system operating departments of the two companies.

Normally, no attempt is made to control the direction of the flow of power around the loop interconnections which tie together the Pennsylvania Power & Light Company system and systems B and C. To do so would require special apparatus. The flow of power around the loop is dependent upon the distribution of load, the relative impedance of the transmission network, the location of generating stations and the amount of load carried by each station. The net interchange between the various companies is regulated by changing the loading of certain generating stations.

Under some conditions the power flow around the interconnecting loops overloads the transformers at one of the interconnecting points or causes more power than desirable to flow over certain transmission circuits. Under such conditions it is necessary either to change the loading on one generating station or to open one of the tie circuits. This condition has been partially rectified by installing additional transformer capacity.

This is an illustration of the troubles that are likely to be encountered when an interconnecting tie is of low capacity. Low capacity in this case is, of course, a relative term, depending upon the system capacities and the purpose of the tie.

Experience has shown that the low capacity ties frequently trip out under normal operating conditions due to momentary load swings or due to excessive transfer of power under certain desirable loading of the various generating stations of the interconnected systems. This kind of operation is undesirable and such ties should be strengthened if practicable.

It is quite possible that in the future it will be desirable or necessary to control the flow of power over some of the interconnecting ties by some means other than changing the loading on generating stations.

Frequency Regulation.—Frequency regulation has offered some problems, but these have been satisfactorily solved. Previous to the interconnection with system A the frequency of the Pennsylvania Power & Light system and of systems B and C was maintained by having several of the larger steam-electric stations regulate the system frequency together. Each of these stations had a definite scheduled load and was instructed to regulate to keep the frequency at 60 cycles until the load on the station deviated 2,000 kw. from the schedule. Whenever either load limit was reached the station notified the system operator, who either set a new load limit for that station or requested a change in loading on one of the other stations. The frequency chart in Fig. 2a illustrates the results obtained by this method of regulation.

The addition of a 40,000-kw. hydro-electric station to the system caused the frequency regulation to be assigned to this station whenever load and water conditions permitted in order to decrease the load swings on the steam stations. Somewhat later an automatic frequency controller was installed at this hydro station which regulated frequency by adjusting the governors of the hydro-electric units by means of their synchronizing motors. This automatic regulator held the frequency of the interconnected system, the average peak load of which at that time was 250,000 kw., within the limits of plus and minus 1/20th cycle. The average load swings on the hydro-electric station were between 15,000 and 20,000 kw. The load swings on the regulating station and the resultant frequency with automatic regulation are shown in Fig. 2b.

This same method of regulating frequency was continued after the interconnection with system A was made, although the capacity of this company is about twice that of the Pennsylvania Power & Light Company and B and C systems. When the automatic regulator at the hydro-electric station was in service, the average load swings on this station were from 30,000 to 40,000 kw. However, after some experience in operating with this additional interconnection, the swings on the regulating station were reduced to a maximum of about 30,000 kw. and the frequency variation again approached the limits usual before this system was tied in. It was found that frequency was considerably improved by allowing the load on the interconnection with system A to swing, thus taking advantage of the diversity between the load swings on the two systems. The results obtained after four weeks' operation interconnected with system A are illustrated in Fig. 2c.

After some experimentation, it was agreed by the Pennsylvania Power & Light Company and company A that in order to divide the work of frequency regulation about equally one company would regulate frequency for the entire interconnected system whenever the other company would be at a disadvantage if required to regulate. This method of operation is possible due to the time divergence in the peak-load period of the two systems. When one system regulates frequency the other system maintains the desired load on the interconnection.

Considering Automatic Frequency Regulation

Since seasonal water conditions and daily load conditions make it impossible continuously to regulate frequency on a hydro-electric station some other means must be adopted to obtain the benefits of continuous close frequency regulation. Therefore, consideration is being given to the installation of automatic frequency controllers in the major steam-electric stations of the interconnected system. If these controllers are designed to hold the load swings on the individual generators within economical limits, each major station of the interconnected group can be made to take its fair share of the load swings causing frequency variations. By this means the same scheme of regulation as practised by the Pennsylvania Power & Light Company when controlling frequency regulation by steam stations before the automatic controller was installed at the hydro-electric station can be continued. Combination load and frequency controllers are at present undergoing trial at one of the Pennsylvania Power & Light Company's steam-electric stations.

On the Pennsylvania Power & Light Company system each of the major generating stations is equipped with a General Electric tuned type frequency indicator, a Leeds & Northrup frequency recorder and a Warren frequency clock. The Hazleton system operators' office is equipped with a General Electric tuned type frequency indicator, a Leeds & Northrup frequency recorder, a Leeds & Northrup frequency indicator and a Warren master clock.

The Leeds & Northrup frequency recorder and fre-

quency indicator are the ones normally used in regulating system frequency. Instantaneous variations in frequency can be noted on the frequency indicator, while the width of the frequency band on the frequency recorder is an indication of how closely the required frequency is being held. A close check is also kept on the divergence of synchronous time against standard time on the Warren master frequency clock. Correct time for this clock is received daily from Arlington. The actual daily divergence of synchronous time from standard time is kept at a very small value.

In regulating frequency on an interconnected system the practice has been to compare periodically the records on the Leeds & Northrup frequency recorders at the various system operating offices. On each individual system these meters at the control center are used as a standard for the system and the generating stations on the several systems compare their frequency recorders with the one at the control center. Should it happen that the recorders in the system operators' offices do not agree exactly, the records on these are compared with the records of the Warren clock at each location and the one which is the most accurate is used as a standard.

Difficulties in regulating frequency during change of load periods, such as the morning, noon and late afternoon periods, are overcome by having the various stations change their loading according to a predetermined schedule. This allows the frequency regulating station to take the large swing during these periods and also permits the individual station to speed up the changes in its load so as to keep the frequency constant when the indications show that the regulating stations have reached either of their load limits. As an illustration, during the morning pick-up period each generating station is given a definite time at which it should reach its scheduled load and is instructed to regulate its load up to this schedule, maintaining normal frequency.

Changes in loading on the interconnections are also handled in the same manner. The company sending the power over the interconnection is given a definite

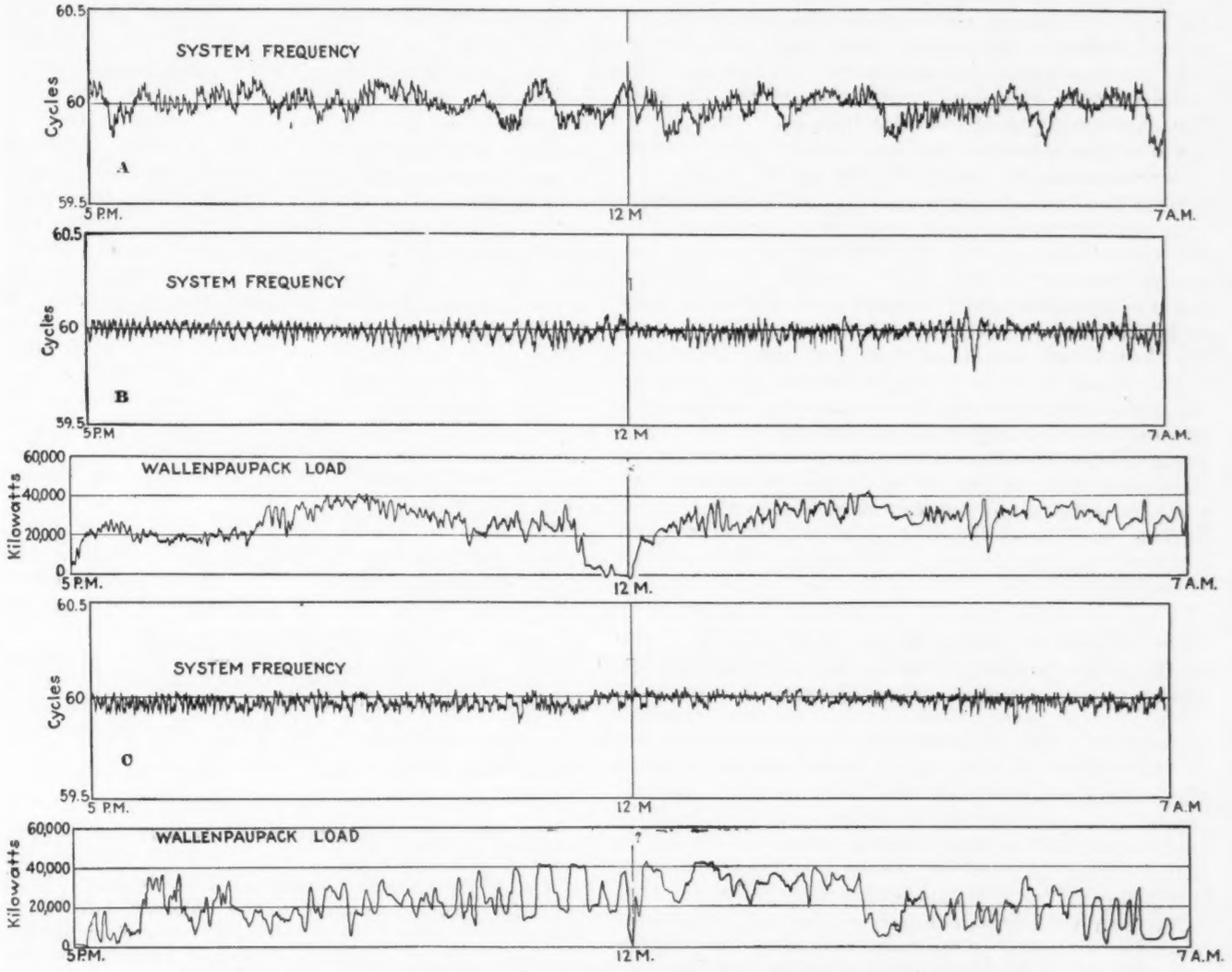


Fig. 2 a, b, c—Degree of Frequency Regulation Maintained Under Different Conditions and Methods

(a) Prior to interconnection with system A several large steam stations jointly regulated frequency. Each station had a definite load schedule and was instructed to keep frequency at 60 cycles until load deviated 2,000 kw. When limit was reached a new allocation of loads was made by system operator.

(b) Also before interconnection with system A and after 40,000-kw. hydro plant was added to Pennsylvania Power & Light system automatic regulation of governors at this plant resulted in system frequency and station load swings as recorded.

(c) After interconnection with system A automatic regulation caused 30,000 to 40,000-kw. load swings at hydro plant. These were reduced by taking advantage of inter-system diversity.

time limit in which to make the load change. It has been found that with the present interconnected group it is best for the company receiving the power to regulate the frequency for the entire interconnected system and for the company sending the power to control the flow.

All Regulate During Emergencies

Whenever emergencies occur causing the system frequency to become abnormal all the stations on the system, including the so-called fixed load stations, regulate frequency in order to restore it to normal. The various station operators notify the system operators that they are regulating so that they may again be relieved of this regulation and have their loading restored to normal when the emergency has passed.

Should a trip-out separate one part of the system from another and cause an overload on one section of the system which forces the frequency below normal, enough load is dropped in this section to enable the stations to restore their frequency to normal as soon as possible and synchronize with the rest of the system. The load which was dropped is then again picked up.

Experience has shown that the best way to supervise frequency regulation on an interconnected system is by the use of recording instantaneous frequency charts. Instantaneous variations in frequency from normal must be kept at a rather low value, on the order of 1/20th cycle, in order to prevent excessive load swings on the various interconnecting lines, and a recording chart showing the instantaneous frequency allows closer supervision.

Wattless.—The metering of wattless is necessary in order to meet the requirements of interconnection contracts, which usually contain clauses penalizing low power factor. Generally speaking, each system in an interconnected group should supply its own wattless, although this may be modified under certain conditions.

The flow of wattless is, of course, dependent upon the voltage gradient, and this is frequently a difficult matter to control within the limits desired. Where the interconnection is made without transformation the actual voltage carried on the two systems may vary sufficiently to cause a considerable transfer of reactive-kilovolt-amperes from one to the other. If the normal direction of power is the same as that of the wattless no difficulties may be encountered. The difficulty may also be overcome by changing the voltage of one system or the other at the point of interconnection.

Where the interconnection is made through transformers, the taps may be adjusted to control reactive interchange for any given set of conditions. However, if power is interchanged in both directions it may be necessary to install some means for controlling the reactive component. This can be done by installing transformers equipped for changing taps under load, the installation of synchronous condensers, or a combination of the two. An induction regulator can also be used, but is not as efficient as the other schemes.

On some of the interconnecting loops the flow of both the power and wattless is in the same direction around the loop, so that although the power factor on the interconnection line is not unity the actual exchange of reactive-kilovolt-amperes is very small. This makes a very desirable operating condition, since each company can maintain its voltage at the most desirable value and it is unnecessary to install any corrective equipment.

At the point of interconnection with system A power is interchanged in both directions and is of considerable magnitude—in the neighborhood of 50,000 kw. It has been necessary to operate hydro-electric generators as synchronous condensers during certain periods in order to control the power factor on the interconnecting line. At the present time transformers equipped for changing taps under load are being installed to give better voltage control on this interconnection and in the future synchronous condensers will also be installed so that both the voltage and power factor can be properly controlled.

Relaying.—The relaying of the various interconnecting circuits is not particularly complicated, the main problem being the determination of relay settings to meet the requirements both of the tie circuit itself and of the interconnected system directly affected. Overcurrent relays are used on the light and heavy tie circuits, operating with power in either direction. Overcurrent and directional relays are used on the tie circuits, requiring a heavy tie to the smaller system and a light tie to the larger system. Due to the light setting required on the directional relay, a type of directional relay is used which short circuits the overcurrent relay with power toward the smaller system. The scheme is used to prevent the overcurrent relays from operating when trouble occurs on the smaller system. Upon the clearing of such trouble a momentary power reversal would cause the tie line oil circuit breakers to trip if the overcurrent contacts were already closed.

The relay settings on tie lines are sufficiently high to permit the maximum help to be given either system under abnormal conditions. Tie circuits which include transformer banks have relay settings of at least 100 per cent in excess of the transformer bank rating. Tie circuits requiring two relay settings to meet the operating conditions are equipped with two sets of relays, either of which can be readily cut in service by means of a small switch in the trip circuit, thus making it unnecessary to change the settings.

Relaying Affects Stability

The relaying of interconnected systems has a direct bearing on the stability problem, which is always a part of the interconnection problem. The reduction of the time for clearing a fault is the constant aim of the protection engineer and this is of utmost importance from the stability standpoint. System disturbances from one system are reflected into the interconnected system and speed in clearing a fault is important. There must be close co-operation between the organizations of the interconnected companies in order to obtain the maximum speed in relay operation consistent with the requirements of the individual systems.

Fast and proper system relay operation requires careful short-circuit study of the complete interconnected system. The calculating table offers the best solution and by applying the method of symmetrical components short-circuit current in the case of phase to ground faults can be determined. Ground relays are being applied with satisfactory results and the determination of ground current for phase to ground faults is very necessary where these relays are used.

Education and Instruction.—Representatives of the other interconnected companies periodically attend the weekly meetings held by the Pennsylvania Power & Light Company system operating organization, which affords an opportunity to get together for a free discussion of

operating problems. Further experience and knowledge of interconnection operating requirements are obtained by periodic visits to the various system operating offices and major stations which are part of the interconnected network.

Agreement on system operating jurisdiction over each interconnection is definitely outlined by written operating instructions which have been prepared and agreed to by the companies involved. These instructions cover both normal and emergency operating conditions. The principle of the written emergency instruction is to allow restoration of service promptly by the station controlling the interconnection with or without telephone communication with their respective system operators. The plan of having the station proceed with the handling of an emergency without positive instructions from the system operator is of prime importance if the duration of the emergency is to be reduced to an absolute minimum. When a system operator has immediate communication to the station involved in the emergency he handles the emergency, adhering as much as possible to the written instructions provided for the purpose.

Communication.—To handle successfully interconnection dispatching with a minimum delay direct communication between system operating centers is absolutely necessary. It is also necessary that each individual company have a reliable scheme of communication between its system operating office and the various generating stations and substations on its system so that the necessary instructions for making changes in loading, handling switching, etc., can be rapidly transmitted.

It is necessary, therefore, that the communication service be reliable and rapid. It must function under all conditions of weather such as sleet, wind, lightning, rain, etc. The single line of communication should not be depended upon to fulfill all these conditions. There should be some back-up system.

Communication between the Hazleton system operating office and the system operating office of company A is maintained by means of a commercial circuit which is in cable and, therefore, very reliable. Communication with system C is maintained over several private telephone circuits, while with system B either a private telephone circuit or carrier current may be used.

Blocking.—The common practice of providing protection to maintenance crews involving the blocking of circuits is executed in a manner agreeable to both companies. The accepted practice in cases where each company maintains a reliable protective system is that each company's system operator direct the switching at his end of the line and applies his tag to block the circuits. In cases where one of the companies does not have a protective system which is mutually satisfactory the practice has been established that the more reliable protective blocking method is applied to both ends of the interconnection.

Metering.—Metering the power over interconnections presents a number of special problems. Usually the interconnecting transmission lines traverse a certain amount of the territory of both companies and generally the point at which the transmission lines cross the dividing line of the two territories is not a convenient point for metering, therefore there must be some method of determining and of properly allocating the line losses. It is also usually necessary to meter the wattless or to keep a record of the power factor on the interconnecting lines.

There are several methods of obtaining the line losses. They may be calculated for various rates of power flow and plotted on a curve. From the record of the duration of the interchange the average power flow can be obtained, which, referred to the power flow-loss curve, will give the average kilowatt loss for the average load. This result multiplied by the hours of interchange will give the total losses.

A second method which can be used when the power is metered at both ends of the interconnection is to take the difference between the meter readings measuring the power flow in one direction at each end of the line. The losses thus obtained are apportioned between the companies according to the length of line in their respective territories and the proportions added or subtracted as the case may be. Difficulty is usually experienced with this method when the interconnection is operated on a nearly balanced basis. The low power flow in such cases, together with extremely low and variable power factor, makes it practically impossible to secure accurate metering.

A third method is to have the companies agree on a flat per cent loss on the line in question and apportion the losses thus obtained according to the length of line in their respective territories.

A fourth method is to install an ampere-hour meter on one phase at the metering location. This meter will integrate the square of the current in one phase. Multiplying this by three and knowing the resistance of the conductor, the losses can be readily calculated. This method eliminates the errors introduced in averaging the power flow according to the first method and the inaccurate readings obtained due to low power factor in the second method.

Accurate records must be kept of all meter readings for the different periods of interconnection. It is also necessary to note accurately the time of the beginning and the end of each interchange period in order to determine the loss by the average flow method and also segregate the amount of energy flow at the different rates for interchange power. Depending upon the equipment operating and upon the different periods of the day, there may be three or more interchange rates applied within a period of 24 hours.

The contracts between the various interconnected companies specify the interchange rate to be applied for various operating conditions. These contracts should be so worded that the operating men will not be hindered in operating the entire interconnected system to obtain the maximum economy.

Domestic Consumption Reflects Range Sales

FOR the year ended April 30, 1929, domestic consumption on the Southern California Edison Company's system reached the total of 601 kw.-hr. per customer per year, as compared with the national average of 456 kw.-hr. per customer. The company's domestic consumption curve made a definite upward turn about three years ago, when an aggressive sale of ranges was begun. The result of this merchandising activity is clearly indicated by a continuous upward trend of the consumption curve since.

During 1926, 2,600 ranges were sold. At the beginning of the year consumption was 425 kw.-hr. per customer

and by the end of the year had reached 445 kw.-hr. Range sales in 1927 amounted to 3,000 and consumption at the end of the year had increased to 512 kw.-hr. For 1928 range sales were 5,200 and consumption 512 kw.hr. By the end of April of this year the figure had reached 601 kw.hr. and was increasing at the rate of 5 kw.hr. per month, with no indication of a falling off.

These figures have demonstrated to the satisfaction of company officials the desirability of the electric range load.

Future of the Residential Lighting Field

By M. Luckiesh
National Lamp Works of General Electric Company
Nela Park, Cleveland

THE saturation point in the home-lighting field is not in sight. The total residential-lighting load has increased from year to year because of increases in the average customer's load and because of increases in the total number of customers.

During the past year more than 1,000,000 residential customers have been added to central-station lines. There still remain nearly 9,000,000 residences not being served, of which more than 3,000,000 are within easy reach of central-station lines. Based on the present average wired home, the residential field will purchase about 135,000,000 lamps for renewals and at least 15,000,000 for initial installations during this coming year. Furthermore, assuming only a normal increase in the number of average customers, we may expect an increase in lamp sales of more than 15,000,000 lamps per year for several years.

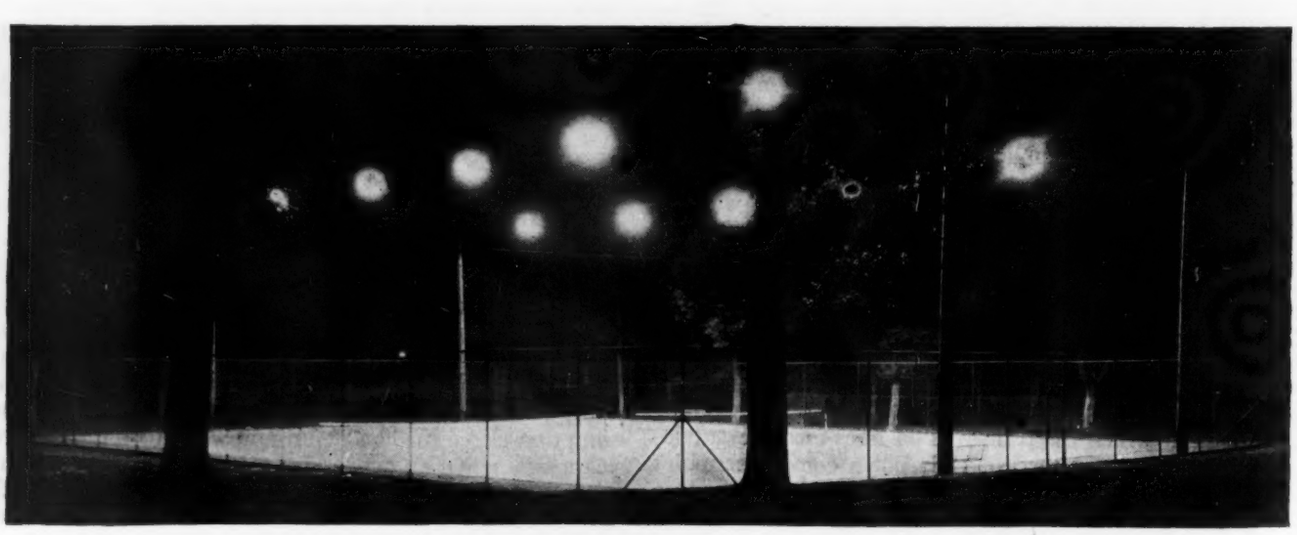
Tremendous increases in this field are possible by increasing the average load per customer. Illumination levels are very generally far below those desirable or economically possible. Convenience is far from satisfied from the viewpoint of lighting. The use of light for asthetic and specific psychological effects has barely begun. Then, finally, luxurious lighting is still to be developed.

Our investigations show that, from a purely utilitarian viewpoint, the homes in this country are less than half-lighted. For convenient and useful lighting the homes need at least twice the present connected lighting load in watts. Even after this level has been reached there still remains the job of raising the standard of utilitarian lighting. A home which we lighted for convenience and utility has 3½ times the connected load in watts of the present average home for the same number of rooms. None of these possible increases includes the decorative use of portables, brackets, etc., or any of the enormous possibilities of distribution and quality of light for esthetic effect. Our estimates indicate that a reasonable fulfillment of this program would easily double the number of lamps used in this home.

A figure quite generally accepted for the average annual kilowatt-hour consumption for the residential customer is 429; however, one group places it as high as 473. Quoting this latter group: "It is estimated by several properties with experience in new-business development that 3,000 kw.-hr. per year per customer can be obtained if sales efforts are aggressive." This figure of 3,000 is to be attained largely by the sale of refrigerators, oil burners and ranges, which involve relatively high initial expenditures. It should be relatively easier, if certain pitfalls not involving the customer directly are avoided, to increase the average load by the sale of more lighting equipment and more hours of use which do not involve large initial expenditures. If appliance sales with large initial investments are not handicapped by fear of operating cost, then lighting with its low initial investment should be sold readily by aggressive sales effort.

Night Illumination Keeps Tennis Courts Busy

HIGH-intensity illumination and absence of glare in the lighting of two tennis courts in Denver's city park has produced a demand for night playing which keeps the courts busy until 10:30 p.m. Even during the past winter the courts were in use except during storms. Many experts declare they prefer artificial to sun light as they are able to play a faster



Absence of Glare and High Intensity of Illumination Has Made Night Tennis Popular in Denver

game by reason of improved vision and lack of enervating heat.

Above each of the two concrete paved courts are suspended five 1,000-watt units on steel messenger wires at a height of 32 ft., furnishing an average intensity of 18 foot-candles. Distribution of illumination is practically uniform over the entire playing area. The central location of lighting units above players, instead of at borders of the courts, diffuses the light almost 100 per cent and eliminates shadows.

The installation cost $375 and was designed by F. S. Peterson, illuminating engineer of the Public Service Company of Colorado. Popularity of night playing has caused the city to consider seriously similar installations in three other municipal parks.

Letters from Our Readers

Accuracy in Contributions for Publication

To the Editor of the ELECTRICAL WORLD:

In the April 13, 1929, issue of the ELECTRICAL WORLD there is an article by King Hamilton Grayson entitled "Electrical Progress in Japan," in which I note that on page 730 there is a statement to the effect that the Tokio Denki and the Westinghouse are listed there in combination. This is incorrect and should be Westinghouse Electric Company of Japan operating as an individual company with the Mitsubishi Denki K.K. licensee, and not Tokio Denki. In addition the Tokio Denki is tied up with the General Electric Company on the lamp and Shibaura Works with the General Electric Company in the manufacture of machinery. In addition there is a statement that Nippon Dento and the Western Electric are tied together; this should be Nippon Denki.

On page 731, under the picture giving a street scene in Nishinemiya, this should be Nishinomiya. Another case of incorrect spelling was on page 730, giving the various industries in combination where it was written out "Furuhawa" being tied up with Siemens-Schuckert, this should be Furukawa. It is very necessary that the Japanese names be spelled correctly as sometimes mis-spelling changes the meaning, and in one case we had a very embarrassing situation because of mis-spelling.

C. A. JOHNSON,
Engineering Manager.

Westinghouse Electric Company of Japan,
Yusen Building, Marunouchi, Japan.

Cables Dance in Nebraska

To the Editor of the ELECTRICAL WORLD:

We note with interest the article by W. K. Archbold in the Jan. 26 issue of the ELECTRICAL WORLD entitled "Dancing Cables Affect Service." Our company has experienced this trouble to a marked degree and at times our men have been on the spot when the conductors are "dancing" or whirling. The trouble seems to be most pronounced on east and west lines when the conductors are covered with ice and with a northwesterly wind blowing.

The whirling action of conductors has been explained to our satisfaction by referring to the anology of the youthful game of whirling or spinning a button attached to the middle of a string. In this sort of game the horizontal pull exerted by the hands in pulling the string tight and loose in turn makes the button whirl in a circle or loop.

Applying the same principle to transmission lines we have a tightly stretched conductor loaded with ice. The tension in this conductor may be changed by either changing gusts of wind or by ice dropping off part of the conductor. These varying changes in (horizontal) tension in the conductor if repeated at the proper frequency may cause the conductor to assume a rotary motion, the same as the button in the above illustration.

When a conductor once starts to whirl it will continue to do so for a considerable time, due undoubtedly to its inertia and also to the fact that additional gusts of wind or melting of ice add additional energy to this motion. The whole process resolves itself into the changing of horizontal motion into rotary.

Our company does not attempt to construct transmission lines with sufficient clearance between conductors to prevent them from coming in contact if one or both of them are whirling. The phenomenon is experienced on the average of one or two times every winter, which is not excessive, as 1,700 miles of transmission line is operated.

B. ELLSWORTH,
Assistant Engineer.

Iowa-Nebraska Light & Power Company,
Lincoln, Neb.

An Appreciation of a Pioneer

To the Editor of the ELECTRICAL WORLD:

When a veritable martyr to science in the person of William Symes Andrews, consulting engineer of the General Electric Company and an early assistant of Thomas A. Edison, passed away at his home, 1018 Park Avenue, Schenectady, N. Y., the afternoon of July 1, 1929, the world at large lost one it will be difficult to replace. Endeared as he was to scientists and technicians for his many contributions to theory and practice, he was equally endeared to all whose privilege it was to really know him, as a man of lovable character, sterling integrity, seeing the good, and only the good, in every situation with which he was confronted. Handicapped by many afflictions for several years and for many months confined to his bed because of these afflictions, all the direct result of his earlier efforts for the advancement of science, his constant thought was that of gratitude to God, and to those who ministered to his requirements, that his lot was not as bad as it might have been. To those familiar with his condition it would be difficult indeed for any but natures such as his to conceive reasons for gratitude, but Mr. Andrews saw them and never failed to express them. The superlative spartanism he exhibited throughout his illness, in fact throughout his entire life, will long remain a cherished memory.

Mr. Andrews' contributions to the electrical industry, as well as to science in general, were numerous. He was one of the loyal band of workers who assisted Mr. Edison in the early electric light experiments at Menlo Park, N. J., as well as in the practical development of the electrical industry resulting therefrom. Had he lived until December next he would have celebrated his Golden Jubilee with the industry he did so much to perfect. That he did not is a loss to science and to those privileged to call him friend.

F. A. WARDLAW,
Secretary.

Association of Edison Pioneers New York City.

Digest of Electrical Literature

Transmission, Substations and Distribution

The Lightning Problem.—By H. M. Towne.—This is the second installment of a series examining into the contributing factors of surge disturbances on high-tension lines and an explanation of the progress of the studies in lightning arrester protection. In this part the author discusses the influence of line insulation, grounded versus non-grounded neutral systems, system voltage and arrester rating, control of generators, accomplishments desired of arresters and cathode-ray oscillograms. Several of the latter are presented to show the action of the pellet type arrester on steep impulses with and without ground resistance. Current, voltage and power relationships with a traveling wave are given for several conditions.—*Electrical News and Engineering (Toronto)*, August 1, 1929.

Generation, Control, Switching and Protection

Brush Marks on Collector Rings—M. Perrier.—On slip rings of rotary converters are found sometimes burn marks of very uniform appearance and with regular spacing. Studying this phenomenon, the author found that such marks are found only on collector rings, to which alternating-current is carried in brushes. Acting alternately as anodes and as cathodes, the brushes begin and gradually enlarge burn marks, the location and spacing of which stand in direct relation to circumferential speed, number of brushes and frequency. When carried too far, these marks may cause excessive brush wear, but the author shows that with proper spacing and a certain number of brushes the appearance of these marks can be entirely avoided.—*Revue Générale de l'Electricité*, June 29, 1929.

Switching of Large Energies.—F. Kesselring.—The results are given of experimental investigations on a large scale, studying the complex phenomena of closing and opening large amounts of energy in air and under oil. In closing a circuit initial sparkover, the gradual decrease of resistance, dynamic forces and welding of contacts have been systematically investigated. A model arrangement, with which the dynamic forces on closing have been measured, is of interest. Much more involved, and practically inaccessible to mathematical treatment, is the opening of circuits. Well-planned experiments on a practical scare are at present the only safe method of approach. Tests on explosion chamber type of breakers seem to indicate that their use can only be recommended up to 45 kv., while for higher potentials a multi-break switch is safer. The author holds small hope for the vacuum breaker, because an evaporation of the electrode metal defeats a clean and quick break. Up to 400 megawatts were successfully ruptured with the air breaker, using a high power jet of compressed air into the arc zone. Good results up to 12 kv. and 400 megawatts were obtained with the recently developed "Deion" air breaker. Almost limitless energies can be ruptured under oil with an auxiliary pre-contact and an adjustable resistance, mechanically interlocked with the breaker in such a way as gradually diminish the resistance between the time the breaker moves from the pre-contact to the main contact, the operating cycle requiring 1/3 to 1/2 second. — *Elektrotechnische Zeitschrift*, July 11, 1929.

Electrophysics, Electrochemistry and Batteries

Changes of Dielectrics in Humid Air.—F. Moench.—The author measured the increase of weight and the dielectric loss angle of cable paper, wood, pressboard and Bakelized paper after lying for a period of 24 days in an air chamber with 65 per cent and later 80 per cent relative humidity. The desired degree of humidity was kept constant by means of a calcium chloride solution and was measured with a hair-hygrometer. At 65 per cent humidity the loss angle of pressboard rose from an initial value of 0.1 within four days to a constant value of 0.26, after which the humidity was raised to 80 per cent, causing a further increase of the angle to 0.53. Under similar treatment Bakelized paper started from 0.03 to only 0.04 and 0.06 respectively. The measurements were made with a Schering bridge and a frequency of 800 cycles. The test showed that a prolonged influence of 80 per cent humidity has a far more pronounced effect than submerging in water. It may be assumed that a test at 80 per cent humidity resembles very closely that amount of water which fibrous dielectrics can possibly absorb at normal use. — *Elektrotechnische Zeitschrift*, June 27, 1929.

Motors and Control

Explosion-Proof Induction Motors.—E. Tochtermann.—The use of induction motors with wound armature and collector rings is not permissible in locations where explosive gas mixtures are present, such as some coal mines, oil wells, gas plants, etc., unless special provisions are made to inclose the brushes hermetically. Motor constructions of this type are described in the present paper. According to the service, and, to some extent, according to the gas, several designs of protections are customary. Methane and illuminating gas mixtures with air, causing less violent explosions, call for a pressure-proof inclosure of slip rings, placed flying on the motor shaft, outside of the bearing. Hydrogen-air explosions are much more difficult to handle and require either the addition of a labyrinth stuffing box or ventilation of the inclosure to an outside room with fresh air. Auxiliary apparatus, such as starters, are of the oil-immersed type with cable end-bell connections. — *Brown, Boveri Mitteilungen*, July, 1929.

Heat Applications and Material Handling

Application of Electric Water Heaters.—F. Hartmann.—Among the various electric appliances, domestic water heaters, operating during the off-peak periods, represent the most desirable central-station load. As an outstanding and probably world record case, the author mentions the city of Basil (Switzerland), with a population of 140,000, with 6,100 electric water heaters installed, representing 12,500 kw. The night load in that city is 60 per cent of the peak load. A theoretical study is given first, to show the maximum rate at which electric heating can compete with gas and coal. Numerical examples are then given to show how efficiency and costs compare for water heating with these three heating sources. A very extensive discussion is given of how heaters can be equipped, installed, paid for and operated. To avoid heating during peak-load periods time switches, telechron motors, or specially wired time relays can be used. It was also attempted to switch heaters in direct-current supplies in and out by a momentarily superimposed alternating-current impulse. Where time switches are used, the cost of which is somewhat high, a block of houses can be served by one central timer.—*Revue Générale de l'Electricité*, July 6, 1929.

Miscellaneous

Electric Power for Comfort.—Symposium.—This special issue of the magazine is devoted to a great variety of small and large domestic and public applications of electric power to ease the burden of the householder, to beautify home, office and buildings, to light and ventilate, to advertise and to amuse. Twenty-four articles, profusely illustrated, show the latest achievements and most modern types for all of these various branches of daily life and comfort. Among these 110 pages will be found many novel devices, such as, for example, oddly shaped illuminating fixtures. Much information is contained in articles on the electric equipment of a large department store, a modern motion-picture house and an amusement park. — *A.E.G. Progress*, June and July, 1929.

Book Reviews

Electrification of Steam Railroads

By K. T. Healy, New York: McGraw-Hill Book Company, Inc. 394 pages, illustrated. Price, $5.

The author discusses physical and economic considerations involved in steam railroad electrification. Emphasis has been placed on power supply contracts, overhead distribution systems and economic data as essential elements.

The author has studied American and European systems of electrification carefully and has not hesitated to express his opinions in the book. The treatment of the technical engineering features is thorough and well detailed, but the great value of the book is the ever-prevalent economic and operating point of view kept in front of the reader. A typical chapter on power contracts well illustrates the railroad and utility point of view and gives invaluable pointers to those concerned with this problem. The book impresses the reviewer as being the right book at the right time on a very important and live subject. It will prove useful to executives and engineers interested in this topic and should be a valued text for colleges.

Introduction to College Physics

By Clinton Maury Kilby. New York: D. Van Nostrand Co., Inc. 349 pages, illustrated.

Very frequently a brief course in physics is given to women and to others not specializing in this science. This book was written for such college courses and bridges the gap between the high school text and the more elaborate college texts. The author outlines fundamental principles covering kinematics, dynamics and hydrodynamics in the section devoted to mechanics and allocates other sections to magnetism and electricity, heat, sound and light. The treatment is orthodox and thorough and each chapter contains illustrations and problems.

The Radio Manual

By George E. Sterling. New York: D. Van Nostrand Company, Inc. 666 pages, illustrated. Price, $6.

This is a practical treatise on radio and associated equipment and is prepared as a textbook and guide for those interested in any phase of radio. In a concrete way the author covers elementary electricity and magnetism, motors and generators, storage batteries, vacuum tubes, transmitters, modulating systems, radio hook-ups, radio broadcasting equipment, spark transmitters, radio beacons and guides and short-wave apparatus. These chapters are well illustrated with photographs and drawings and are practical instead of theoretical.

In addition to the technical content the author gives radio laws, traffic handling, radio scheduling and many valuable tables to cover the commercial and application aspects of the art. The book should prove very useful to inspectors, amateurs and those desirous of becoming radio operators and mechanics.

Standard Wiring

By H. C. Cushing, Jr., New York, 501 pages, illustrated. Price, $3.

The 1929 edition of this popular guide to wiring for light and power maintains the standards of past editions. The book is completely revised to conform to the latest Underwriters' Code and contains many explanatory notes, sketches and directions for helping those interested in wiring.

Mathematical Tables and Formulas

By P. F. Smith and W. R. Longley. New York: John Wiley & Sons, Inc. 66 pages. Price, $1.60.

This popular group of tables and formulas has been compiled to aid engineers and students in solving problems. The tables are well arranged and include squares, cubes, square roots, cube roots, reciprocals, trigonometric functions, logarithms, degrees, radians, exponentials and hyperbolic functions.

Siemens Jahrbuch, 1929

Issued by Siemens & Halske A.-G. and Siemens-Schuckertwerke A.-G. Berlin: V.D.I.-Verlag G.m.b.H. 644 pages and numerous illustrations, including nineteen plates.

Not a statistical summary but a running account of electrical developments in many fields, the book comprises about 40 monographs in addition to material appropriate to the centenary of the birth of Karl Von Siemens and extracts from letters written half a century ago by Werner Von Siemens, when the latter was urging the more general introduction of arc lighting. The book is therefore in a sense a memorial to founders and leaders of the great organizations whose name it bears.

The historical reviews in many of the chapters provide an interesting background of the past for a general survey of recent achievements, in which the contributions of the organization sponsoring the book naturally receive adequate but not obtrusive mention. In a composite product, such as this, differences of treatment are to be expected. Some articles are descriptive and historical; other lean more toward technical discussion. Examples of the latter, taken at random, are the sections on the efficiency, depth of current penetration, power factor and choice of frequency for high-frequency induction furnaces, on ring fire on d.-c. machine and on turbine design. Chapters on X-ray examination of materials and on the possibilities of beryllium exemplify the application of new processes or methods.

Book Notes

PROCEEDINGS OF THE INTERNATIONAL CONGRESS ON ILLUMINATION. Easton, Pa.: The Chemical Publishing Company, 1443 pages, illustrated. Price, $10.

During 1928 at the Saranac Inn in New York the International Commission on Illumination had a meeting in conjunction with a meeting of the Illuminating Engineering Society. This book contains selected papers from these two meetings and presents illumination engineering on an international scale. Papers are printed in the original languages, although contributions in English predominate. The book gives a broad and comprehensive view of the new developments in illumination and of the projects now under way.

RADIO RECEIVING TUBES. By J. A. Moyer and J. F. Wostrel. New York: McGraw-Hill Book Company, Inc. 292 pages, illustrated. Price, $2.50.

This is a practical work on vacuum tubes and their applications. It covers the construction of the tubes, fundamental electrical relations, vacuum tube action, reactivation of the tubes, testing tubes, uses of tubes as detectors, amplifiers, oscillation generators, specifications for tubes, and the industrial applications of vacuum tubes. The treatment is sound, the style good and illustrations help to fix the contents. A very useful and practical book.

ELEMENTS OF RADIO COMMUNICATION. By John H. Morecroft, New York: John Wiley and Sons, Inc. 296 pages, illustrated. Price, $3.

Professor Morecroft has responded to the demand for a briefer and less technical treatment of radio than that used in his splendid "Principles of Radio Communication." This book is written to supply the demand for a brief, thorough and non-metallurgical text on radio. It covers the fundamental principles of electric and radio circuits and discusses the equipment, practices and apparatus used in radio engineering including radio telephony. It is not a popular treatise in any sense of the word, but is sufficiently elementary for the student of radio to grasp tangibly.

RADIO TELEGRAPHY AND TELEPHONY. By R. L. Duncan and C. E. Drew, New York: John Wiley & Sons, Inc., 950 pages, illustrated. Price, $7.50.

Books on radio are many these days, but there always seems to be room for another. This book is a complete textbook on wireless communication written by practical men for practical purposes. It wastes little time on general circuit theory and electrical principles, but hews to the line of telling about the equipment, how it works and how it can be used. It holds to principles as to each piece of apparatus and makes clear its limitations, operation and use in communication. It is a thoroughly good book for radio engineers and students of radio.

News of the Industry

Starting-Current Rule to Be Effective Next June

Electric Utilities May Then Refuse to Serve Motors of One-third Horsepower or Less Operating at Nominal Rating of 110 Volts

NOTIFICATION will be given on January 1, 1930, to their constituent companies, to motor manufacturers and to the Association of Washing Machine Manufacturers by the National Electric Light Association and the Association of Edison Illuminating Companies that after June 1, 1930, electrical utilities may refuse to take on their lines any motor of one-third horsepower or less operating at a nominal rating of 110 volts which requires more than 15 amp. during the starting period. The agreement arrived at says that "all central stations so desiring may establish a rule requiring that all alternating-current, 60-cycle motors of one-third horsepower and less used on washing machines, operating on 110-volt circuits, shall not require starting current in excess of 15 amp. as measured by a well-damped ammeter, and further that a tolerance factor of 10 per cent above this limit will be permissible to allow for variations from 110 volts in service voltage and in manufactured products."

This decision was brought out of a meeting of the joint committee on fractional-horsepower motors of the three associations already named and the National Electrical Manufacturers' Association held in Chicago on August 7. At a meeting of the committee in January, 1929, the above stated rule was offered to be effective on August 1, 1929, but upon representations from motor and washing-machine manufacturers the date of enforcement was not fixed and another meeting of the committee was scheduled for early this month. The washing-machine manufacturers had promised to make diligent effort to apply a satisfactory motor to their products and the motor manufacturers to make such a motor available to them.

Substantial progress was evident in the meeting of August 7. Although none of the motor manufacturers was in a position to get into immediate production and make large deliveries of a motor that would comply with the utilities' requirements, they did indicate that such a motor would be available in adequate quantity by the time the rule goes into effect in June of next year. The washing-machine manufacturers agreed also that by that date they would have had time to apply the newly developed motors to their products.

Throughout the discussion which took place in the meeting of August 7 it was assumed generally that this would be the last session of the joint committee, and since no arrangements were made for further meetings and no reasons for such meetings brought forth, it was assumed by those present that the committee was dissolved, its function having been accomplished by the agreement.

Thus is ended a controversial situation that has existed for a number of years. With the application of the starting-current rule as affecting washing-machine motors the electric utilities will be in a position to protect themselves against voltage dips imposed by motor devices used on lighting service lines. It is not expected that this rule will have a hard-and-fast application on every utility system in the country, because there are many, particularly in the medium-sized and smaller towns, which do not suffer greatly from the effect of motor-starting current on voltage regulation. However, it is believed that the utilities in the larger centers will see a minimization of the number of complaints from this source.

General Jadwin Favors Hydro Project on Potomac

Recommendation that a preliminary permit be granted the Potomac River Corporation of Wilmington, Del,. for ultimate development of a hydro-electric power project at Great Falls, on the Potomac River, near Washington, was made to the Federal Power Commission by Major-General Jadwin just before he retired as chief of army engineers.

In his report, which was submitted last week, General Jadwin declared it was his judgment that the Potomac River Corporation's application for a preliminary permit only should be approved, but "subject to certain provisions for the protection of navigation and park development." Under the law no permit may be issued by the commission until further action has been taken by Congress after consideration of reports to be submitted by the National Capital Park and Planning Commission and the Power Commission.

Three applications for power development on the Potomac came before General Jadwin—one by Stineman & Quick for two dams, one at High Island and one at Plummers Island; one by the South Branch Power Company for certain storage reservoirs and two power plants, one at Great Falls and one at Chain Bridge, and that of the Potomac River Corporation, which is substantially the same as that of the South Branch Power Company, except that it includes also a power plant at Harper's Ferry.

A.S.A. Approves Code

Grounding Regulations of New Edition, Which Coincide with Those Prior to 1928, Thought Satisfactory for the Present at Least

APPROVAL of the 1929 edition of the National Electrical Code as an American standard by the American Standards Association has been declared, and copies of this edition will be available about October 1 from the association of the National Board of Fire Underwriters. Supplies may be ordered now from the association at 29 West Thirty-ninth Street, or the board, 85 John Street, New York. The new edition is the fifteenth revision.

Speaking of the 1929 code, Major H. S. Bennion, director of engineering with the National Electric Light Association, said this week to a representative of the ELECTRICAL WORLD:

"It will be recalled that the revision of the National Electrical Code which was made in 1928 failed to receive approval as an American standard on account of objections which were raised to the grounding rules that it contained. These objections came principally from electric light and power sources, but there was a general appreciation of the fact that the grounding rules contained in the 1928 edition had not received the study that appeared to be necessary before such radical changes could be successfully applied in practice. On account of this situation it was decided to bring out a further revision of the National Electrical Code during the year 1929 wherein the grounding rules would be of a character satisfactory to all concerned. This was actually effected by a return to the grounding rules that had appeared in the code prior to the 1928 revision. The grounding rules in the 1929 edition are in all important respects the same as those of the 1925 code with its 1926 supplement, and they have the further advantage of appearing in an improved editorial form so that there should be little misunderstanding now as to what the grounding requirements of the code may be.

"No doubt the grounding question will receive further consideration in future revisions of the National Electrical Code, but meanwhile the 1929 edition of the code, which enjoys the support of all interested parties and which has been fully approved as an American standard, will contain grounding rules that may safely be applied."

The code was drafted by a sectional committee under the sponsorship of the National Fire Protection Association. This electrical committee contains 75 members and alternates representing 36 national and local organizations.

Solicitor Russell's Views Not Drastic

Newspapers Drew Unwarranted Conclusions from Opinions of the Power Commission's New Counsel on Pre-License Claims of Cumberland Falls Applicant

By Paul Wooton
Washington Correspondent for the Electrical World

THREE opinions on the "legitimate cost of construction projects" rendered recently by Charles A. Russell, solicitor for the Federal Power Commission, have been made the basis of numerous newspaper articles, in most of which unwarranted conclusions were drawn with respect to the Cumberland Falls project in Kentucky and with respect to valuation in general. Owing to the fact that it is the practice of the commission not to make public an opinion of this sort until the applicant shall have had an opportunity to present his views on the points raised, Mr. Russell's conclusions were not given out at the commission's offices. Copies, however, were sent to Senator Couzens of Michigan in response to a request from him. On their receipt he turned the documents over to the press.

Newspapers unfriendly to the Cumberland Falls project thus had a new opportunity to attack the Cumberland Hydro-Electric Company and the Middle West Utilities Company. In other instances the report was made the basis for articles indicating that there is an acute need for the early settlement of unaudited claims of projects awaiting license, these claims approximating a billion dollars. The fact that only an insignificant proportion of this total is in question was not mentioned. When the full text of the opinions prepared by Mr. Russell became available it was apparent that their purport had been misinterpreted. They advance nothing drastic and simply raise points which may be answered satisfactorily by the applicants for a license at Cumberland Falls.

The fact that the new solicitor comes from the Bureau of Valuation of the Interstate Commerce Commission has led some to the thought that he has been inclined to look at the intrastate electrical industry through the same glasses that he used in connection with the valuation of the properties of the interstate transportation industry. There is nothing in the opinions just made public, however, to indicate this point of view.

Press comment describes the two items of $250,000 claimed in the Cumberland Falls case as having been rejected. One of the items covers the purchase of 30,000 shares of stock in the Cumberland River Power Company to be issued to the Middle West Utilities Company and the Cumberland Hydro-Electric Company. This was to pay for the option, engineering reports, license and rights. Whether or not this first item of $250,000 will be eliminated from the fixed capital account will be determined after the company has had an opportunity to present its side of the case. This same process is being followed in a number of other pending cases that have reached the same stage as the Cumberland Falls project. The extent of the obligation in connection with the item mentioned is not clear from the papers which have been submitted in the case. It will be incumbent on the applicant to demonstrate that it represents an out-of-pocket expenditure.

The other $250,000 covers the estimated cost of lands to be turned over to the State of Kentucky for park purposes. The conclusion of the solicitor that it is not admissible as a part of pre-license cost is certain to be challenged.

It is evident from the nature of the opinions that Mr. Russell is attempting without fear or favor to lay down a strict legal interpretation of the federal power act and the court decisions defining its application. If his conclusions are wrong, it is pointed out, they can be upset by court action. If they are right, they will stand unless Congress enacts new legislation.

With reference to overhead allowances, Mr. Russell obviously realizes that no set rule can apply to all power projects, but that each case must be decided on its merits. Railroads are subject to a national code, but on such matters as power and irrigation, on which the laws are different in each state, no fixed law can be laid down as applying to all developments.

Mr. Russell directs Mr. King, the commission's chief accountant, to find the "actual legitimate cost of construction" to be used as a basis for licensing terms. He directs that lump sum or percentage overheads for engineering, supervision, management, financing, development, etc., are to be eliminated from capital accounts. However, he states, overhead items which are an actual cost of the tangible property may be admissible if they are shown to be necessary and proper.

Mr. Russell briefs his opinion on the inclusion of $250,000, or any part of said sum, under contract between the Kentucky State Parks Commission and the Cumberland River Power Company as follows:

As to the amount of money represented by a fixed price per acre applied to the lands owned by the company, it would appear that such is simply a permit of the use by the public of the lands within the project area. The company pays nothing for this other than what has already been paid or may be paid for the lands as a part of the project; it does not dispose of the lands; the proposed use of the lands will not interfere with the operation of the project and is simply a gratuitous gift or concession on the part of the company which does not cost it anything, and, therefore, it is my opinion that in so far as such sum represents the price per acre, as illustrated, that sum is entirely out of the picture and should not, as such, under any circumstances be included in the pre-license cost, or in any cost at any time, as it does not represent any "actual legitimate cost of construction" within the purview of the act.

As to the balance of the $250,000, no part of which has yet been paid—and there is no indication as to when it will be paid—such part is no part of the pre-license cost of this account. It should not be considered in any manner at this time; it has no place in the accounting for the cost of this project until when and at such time as the company shall eventually spend any money on the lands, bridges and highways or in the purchase of land as contemplated by the contract. To insert such an item in the pre-license cost at this time would be pure conjecture and guess and, in addition to that, without any legal basis or foundation for such inclusion.

It is therefore my opinion that in so far as the pre-license cost is concerned to this applicant, no part of the plan under the contract mentioned should be included in the pre-license cost of this project. When and if the company, or its successors or predecessors, pay out any money under the terms of this contract, that question can be decided when the question arises, but it is not now before the Federal Power Commission for a decision except as to its entire elimination.

In a further opinion he says regarding a contract of October 12, 1925, for $250,000 by the Cumberland River Power company "to pay for option, engineering reports, license and rights, and of the undertakings of the Middle West Utilities Company and Cumberland Hydro-Electric Power Company."

It is therefore my opinion from a careful review of all of the facts in this case that this item of $250,000 should be entirely eliminated from the fixed capital account in the pre-license estimate of this applicant, unless the applicant can show actual cost which actually entered into the "actual cost of construction" of the project. Such item or items, determined by this commission, should be added to the capital account, if any are shown.

In still another opinion to Mr. King Mr. Russell says:

From a review of the decisions of the court, which must be followed, supported by the arguments presented in the House at the time of the passage of the bill, the reading of the act can lead to but one conclusion, and that is, that here is the specific direction to the Federal Power Commission to insert in capital accounts the actual legitimate cost of construction limited to the actual amount of money paid therefor. This automatically dispenses with the proposition that there can be included in these capital accounts lump sums of percentage overheads for engineering, supervision, management, financing, development, etc. Such items cannot and must not be included.

However, under the rule, any item of actual cost of tangible property as an overhead, supported by evidence that it constitutes an actual cost of the construction, may be included. Portions of pay and actual expenses of general officers and clerks may likewise be included when it is shown that the same are an actual cost of construction and when it is shown that such were necessary and proper. The inclusion of the items mentioned in the foregoing paragraph should be governed by the facts in each case and no general rule can be made to fit each separate project.

Nebraska Franchise Tax

Public Service Companies Also Suffer from Additional Levies in Assessed Valuation—Street Railways Exempt from Impost

FOR the first time in the history of Nebraska the State Board of Assessment and Equalization has voted to tax franchises. After a series of hearings, the board has announced that it will tax the various public service companies operating in the state a total of $4,888,812 on their franchises and in addition has ordered an increase of 10 per cent in their assessed valuation. Only street-car companies are exempted, on the ground that they pay no dividends.

One hundred and eighty companies are taxed on franchises against two assessments in 1928. This valuation does not include an increase of $3,366,056, or 20 per cent, in the assessed valuation of the physical property of telephone companies, nor an increase of $2,039,092, or 10 per cent, in the assessed valuation of light and power companies, nor an increase of 30 per cent, or $419,280, in the assessed valuation of the two telegraph companies, the Western Union and Postal Telegraph.

The Nebraska Power Company of Omaha and the Northwestern Bell Telephone Company of Omaha head the list, each with a franchise assessed valuation of $1,000,000. The Iowa-Nebraska Light & Power Company, Lincoln, is assessed on $750,000 franchise value; the Central Power Company, Grand Island, on $400,000; Beatrice Power Company, Beatrice, on $40,000; Gage County Electric Company, Beatrice, on $50,000; Southern Nebraska Power Company on $100,000, and Interstate Power Company on $100,000.

The Western Union Telegraph Company, the Lincoln Telephone & Telegraph Company and two Saunders County taxpayers have taken the matter into court, but unofficial information is that the power and light companies of the state will not appeal from the board's action, which was prompted by an opinion of the Attorney-General that it not only had the right but that its duty was to value franchises.

Scenic Issue at Goshen Pass, Va., as Utility Sees It

Inasmuch as the State Corporation Commission of Virginia has decided that it is without jurisdiction to grant or refuse a license for the proposed erection of a dam and water-power project at or near Goshen Pass, in Rockbridge County, the question of going forward with the project becomes of a private nature, Floyd W. King, executive vice-president of the Virginia Public Service Company, says in a statement to the press. While the application of the company for a license was before the commission, nearly five thousand citizens from many parts of the state petitioned the commission to grant one, Mr. King asserts. Such opposition as was entered came from those who wanted to maintain the existing scenic and historic status at Goshen Pass.

"However patriotic may have been the motive of objectors, it lacked the element of fairness to the property owners. The land involved has a value for but two things—water power and scenery. If used for water-power purposes, the owners will be paid for it. If used or reserved for scenery, the owners should be paid for it by those who want it for that purpose," Mr. King's statement declares. He therefore offers to acquire all the lands and rights necessary for his company's project and to turn them over to any responsible contracting parties prior to October 1 for 90 per cent of the company's expenditure on its project up to that time, provided that the land is deeded to the state for public use as a park. If this suggestion is not acted upon, Mr. King says the company will go ahead with its plant, though it will make every reasonable effort to preserve the scenic accessories.

A. G. & E. Completes Last Link in Five-State Network

One of the longest high-tension transmission systems yet built under one ownership—that of the American Gas & Electric Company, extending from Lake Michigan through Indiana, Ohio and West Virginia to the Virginia-North Carolina line, with extensive interconnections both with its own branch lines and with the lines of other companies throughout that stretch of territory—has just been completed through the energizing of the last link—that from the company's Philo (Ohio) plant to Fostoria, Ohio, a distance of about 112 miles. With the addition of this link the company has an unbroken 132-kv. transmission line extending for 980 miles.

The American Gas & Electric line begins at New Carlisle, Ind., where an Insull system line from Chicago is tied in, and runs through South Bend and near Fort Wayne, Ind., to Lima, Ohio, thence to Fostoria and Philo, Ohio, across the Ohio River at Rutland, through Logan, W. Va., to Glenlyn, Roanoke and Danville, Va., and extends to Raleigh, N. C., over the National Power & Light lines.

In addition to its unbroken main line, the system has 300 more miles of high-tension transmission lines, to say nothing of thousands of miles of smaller capacity. Its chief branch lines run from near Fort Wayne to Marion and Muncie, Ind.; from Philo to Canton and Windsor, Ohio; from Rutland to Portsmouth, Ohio; from Keystone, Va., to Kingsport, Tenn., and from Roanoke to Lynchburg, Va. Over the lines of other companies it connects with Toledo, Cleveland and Pittsburgh. The company is now building additional high-tension links from Twin Branch, Ind., to Benton Harbor, Mich., and from Logan, W. Va., to Hazard, Ky.

New-Kanawha Company Alters Hydro Plans

Company Now Desires to Erect One Generating Plant Instead of Two, Building Three-Mile Tunnel—Sandstone Falls Permit Granted by State

A THREE-MILE tunnel under the hills at Hawk's Nest, diversion of a portion of New River through it and the erection of a single power plant at the outlet constitute the revised plan of the New-Kanawha Power Company, as officially made known by the filing of a petition with the Public Service Commission of West Virginia seeking authority to amend the company's original permit for the construction of two dams and two power plants. As originally planned and authorized, the New-Kanawha Power Company was to construct two tunnels, one at Hawk's Nest and the other in the vicinity of Gauley Bridge, and power plants at the outlet of each tunnel, each with a maximum capacity of 50,000 hp. and an average capacity of 36,000 hp. The Hawk's Nest tunnel was to allow a fall of 80 ft. and the Gauley tunnel was to allow a fall of 68 ft., making a total fall of 148 ft. By the new plans the same total fall will be obtained from the one long tunnel and the single power plant will produce as much as the two smaller plants, it was stated. Vice-President L. H. Davis told the commission that 15-ft. crest gates would be added to the height of the dam at Hawk's Nest, thereby improving the plant's efficiency in flood control.

The revised plans also eliminate the necessity of constructing two dams, one at the entry near Hawk's Nest and the second dam at the Gauley entry. Flood danger from the Kanawha would be greatly lessened, it was pointed out to the commission by O. M. Jones, chief engineer, by the elimination of the Gauley tunnel and dam. The commission was also told that the extra cost of the longer tunnel and higher gates would be more than offset by the savings effected by abandoning the second dam.

The New-Kanawha Power Company is a subsidiary of the Union Carbide & Carbon Company of New York, which operates subsidiary plants at South Charleston, Glen Ferris and several other sections of the Kanawha Valley. The power to be generated at the proposed new plant will be used in manufacturing plants to be erected by the company, the principal plant being scheduled for erection at Boncar on land already owned by it.

Another application of the New-Kanawha company, for permission to build a dam at Sandstone Falls on the New River, has just been granted by the commission. This dam will be built to a height of 10 ft. above the falls, with floodgates 7 ft. 6 in. in height. The capacity of the plant is estimated at 27,000 hp. The dam and power house will be in the Green Sulphur district, Summers County, and the Richmond district, Raleigh County. A total of 468 acres will be flooded.

Aluminum Company of America's Plans

Its New Tennessee River Development Will Involve Seven Dams in North Carolina and One in Tennessee at Ultimate Cost of $125,000,000

DEFINITE announcement is reported from North Carolina of the long-looked-for plans of the Aluminum Company of America for a great hydroelectric power development on the headwaters of the Tennessee River and its branches. Eight dams are to be constructed, seven of which are to be in North Carolina, in the vicinity of Bryson City, and the other one in Tennessee. While no estimated output of energy is reported, this, engineers are quoted as saying, will exceed that obtained from Niagara Falls. The ultimate cost of the development is put at $125,000,000. The first plant is to be built at Fontana, N. C., and others will follow at Bushnell, Needmore and Aquone in that state. Some of the sites are already partly developed.

The dam at Fontana will back water to Bushnell, where plans call for the erection of two dams near the junction of the Tuckaseegee and the Tennessee. Water will be backed to a point near Bryson City, on the Tuckaseegee, and a power plant will be built at this point. The dam at Needmore will back water into Macon County for several miles, and the dam on the Nantahala River at Aquone will create a lake extending several miles up the river. The natural fall of the Nantahala from Aquone to Nantahala Station, the probable site of a power house, is more than 80 ft. Construction of the plants will require the relocation of 20 miles of track of the Southern Railway, western branch, and the damming of streams will wipe out six or eight small towns.

Recent formation of the Nantahala Power & Light Company, with principal offices at Bryson City and an authorized capital stock of $10,000,000, is declared to be a step in the plans of the Aluminum company, which, it is presumed, will manufacture power for sale, though no announcement to that effect is made. The Aluminum Company of America has two big power plants on the Yadkin River, in the central part of North Carolina. The power from one of these is used in the operation of its aluminum plant at Badin, N. C., while that from the other is sold to the Duke Power Company.

Pre-License Expenditure on Conowingo Yet Unsettled

Three public commissions must cooperate in fixing the amount which the Susquehanna Power Company may be allowed to place on its books as representing the expenditures it made in promoting the Conowingo development in the pre-license period, according to Harold E. West, chairman of the Maryland Public Service Commission. The commissions are the Federal Power Commission, the Pennsylvania Public Service Commission and the Maryland Public Service Commission.

Difficulties of getting these three bodies to work in unison have thus far prevented the establishment of a figure for pre-license expenditures by the Susquehanna company. A committee of experts working for the three commissions has placed the maximum amount to be allowed for pre-license period expenditures at below $4,000,000. The total which the company has been allowed for all expenditures except those of the pre-license period is approximately $52,000,000.

Washington Electric Company to Develop 192,000 Hp.

An ultimate expenditure amounting to approximately $20,000,000 is foreshadowed by the preliminary permit granted by the Federal Power Commission to the Washington Electric Company of Seattle, a Puget Sound Power & Light Company subsidiary, for its Rock Island power project on the Columbia River at a site near Wenatchee, Wash.

Plans for the development of the initial unit, to cost $12,000,000, must wait on the granting of the federal license. W. H. McGrath, vice-president of the Puget Sound company, stated, but preliminary studies of the situation contemplate erection of a low dam at Rock Island for the generation of 72,000 hp. in the initial unit and transmission of this power to Seattle over two new lines crossing the Cascade Mountains.

Ultimate development of the site, Mr. McGrath said, would entail a probable increased expenditure of around $8,000,000 and would provide for the production of 192,000 hp., to be distributed over the company's system in Seattle and elsewhere in Washington. Under the preliminary permit, he continued, work will be undertaken at once on survey, by United States Army engineers and also by experts of the Puget Sound Power & Light Company, to ascertain probable power development, location of the dam site and other technical data.

Power generated at the Rock Island site would serve the company's eastern district in central Washington, providing a surplus for transmission to the new switching station at Renton for distribution through western Washington. H. A. Hageman, chief consulting engineer for Stone & Webster, is at Wenatchee and will have charge of engineering details for the proposed dam. Under present plans the dam will back water for 5 miles above Wenatchee or 15 miles above the dam.

St. Lawrence Project a Theme of Dispute

Chairman of Great Lakes-Hudson Waterways Association Thinks Revenue from Sale of Power Much Exaggerated—Williamstown Debaters Differ Widely

ENTHUSIASM not warranted by analysis is attributed by Colonel Edward C. Carrington, chairman of the Great Lakes-Hudson Waterways Association, to the backers of a proposal to incorporate the Federal Ship Company, with a capital of $500,000,000, to finance a waterway between the Great Lakes and the Atlantic by using the St. Lawrence River and a New York State ship canal.

The organization of which Colonel Carrington is the head is sponsoring the linking of the Great Lakes and the Atlantic by an all-American route in opposition to the St. Lawrence route. In the latter plan as now projected, which will be brought before Congress next fall in a bill introduced by Representative Daniel A. Reed of New York, an international waterway would be created and the cost of the project would be amortized by the returns from hydroelectric power which would be developed from the Niagara and St. Lawrence Rivers. Millard F. Bowen is one of the sponsors and spokesman for the project. He declares that the pending treaty with Canada for the further utilization of the power resources of the Niagara River should be defeated and that he intends to fight its ratification, maintaining that water needed for navigation should not be taken for power.

Colonel Carrington is quoted as saying a few days ago:

"I have not seen a copy of the bill and am therefore not well prepared to commend or criticise it, but when Mr. Bowen figures on $65.35 a year return per horsepower, or a grand total of $160,000,000 per annum from power alone, I think he is over-enthusiastic. None of the engineers whom I have consulted about the two projected waterways ever indicated or believed that the water power would amortize the construction of the canal."

Williamstown Debates Plan

A discussion of St. Lawrence development was staged last Monday at the Institute of Politics now in session at Williamstown College, Williamstown, Mass. Here marked differences of opinion were manifest as between Canadian and American speakers, those who represented the United States appearing to share the views recently put forth by investigators for the Brookings Institute at Washington. The United States, it was contended, would have to spend $240,000,000 to help Canada develop 4,000,000 hp. as against 1,000,000 hp. for the United States.

Royal Meeker, economist and statistician, former Secretary of Labor and Industry for the State of Pennsylvania,

questioned the desirability of building waterways as a means of regularizing rail rates and favored railroad construction instead.

R. E. Lambert, former lecturer on transportation at New York University, said that the United States would be epected to do all the work in the International Rapids section. He maintained that if the project were carried out the New York State Barge Canal would be useless, and that if the state wished to turn the barge canal into a ship canal it would cost $500,000,000.

Leslie R. Thomson, a member of the engineering faculty of McGill University, Montreal, insisted that a waterway of 27-ft. depth from Lake Superior to Montreal was feasible as an engineering project and its saving in traffic would more than pay for the cost of building. He gave figures to show approximately what the cost would be. The navigation enterprise (apart from the cost of developing 5,000,000 hp. on the St. Lawrence from Lake Ontario to Montreal, which would pay for itself) would cost $360,000,000. Mr. Thomson suggested that Canada should pay one-third and the United States two-thirds.

Dean P. E. Corbett, also of McGill University, dissented from the conclusions drawn in the Brookings Institute report, saying that the estimated cost of $614,000,000 included $250,000,000 for the improvement of harbor facilities. He would deduct the latter amount and then, he said, the estimate would be within $4,000,000 of Mr. Thomson's figure.

So contradictory were the arguments that Dr. William E. Rappard of the University of Geneva, Switzerland, who summed up, said that his viewpoint was that of the "bewildered spectator."

Illinois Commerce Commission Reconstituted

Governor Emmerson of Illinois announced at Springfield on August 5 that he had received the resignations of the members of the Illinois Commerce Commission. The resignation of Chairman Patrick H. Moynihan of Chicago because effective August 1, while Commissioners W. J. Smith of Waukegan, Hal Trovillion of Herrin, J. Paul Kuhn of Batavia and James Clark of Bloomington ended their terms on August 10.

Governor Emmerson on August 10 appointed six members of the commission, Mr. Kuhn being the only one retained from Governor Small's régime. Three of the members are from Chicago and three from downstate. They are: Charles W. Hadley, Wheaton, chairman; G. Gale Gilbert, Mount Vernon, attorney; Walter H. Wilson, Chicago, vice-president Central Trust Company; William H. Brinkman, Chicago, realtor and former member of the Illinois General Assembly; J. Paul Kuhn, Batavia, attorney, and Phil H. Collins, Chicago, insurance broker.

The seventh member of the commission probably will not be named for some time.

Purchases and Mergers

Middle West Utilities Acquires United Public Service Company, Dakota Properties Going to Northwestern Public Service — Transfers Still Numerous

THE Middle West Utilities Company has completed the purchase of the United Public Service Company of Chicago, a fifty-million-dollar corporation operating utilities in Indiana, Ohio, Kentucky, North Dakota and South Dakota. Terms of the sale have not yet been announced. Among the operating subsidiaries affected are the Kentucky Power & Light Company of Maysville, Ky.; Brookville-Lewisburg Lighting Company, Greenville, Ohio; Greenville (Ohio) Electric Light & Power Company; New Madison Lighting Company, also of Greenville; Buckeye Light & Power Company, Covington, Ohio; Eaton (Ohio) Lighting Company; Citizens' Heat, Light & Power Company, Winchester, Ind.; North Dakota Power & Light Company, Bismarck, and Northern Power & Light Company, Mobridge, S. D. As reported in the following paragraph, the Dakota properties have been consolidated by the Middle West Utilities with the Northwestern Public Service Company of Huron, S. D., an Insull property.

Acquisition by the Northwestern Public Service Company of the North Dakota Power & Light Company at Bismarck, N. D., the Knife River Coal Mining Company at Beulah, N. D., and the Northern Power & Light Company at Mobridge, S. D., is announced by T. T. Parker, president of the Northwestern Public Service Company, Huron, S. D. The acquired light and power companies, which serve 84 towns and cities in North and South Dakota, will continue under their present corporate names for the time being, Mr. Parker said. A year or more will be required to interconnect the properties with the systems of the Northwestern Public Service Company. The output of the Knife River coal mines will be used primarily to supply power plants of the Northwestern Public Service Company.

The Board of Railroad Commissioners of North Dakota has granted the Otter Tail Power Company permission to purchase the electric properties at Balfour from A. L. Lombard and at Wimbledon from the Wimbledon Electric Company.

September 3 has been set as the date on which the people of Pierre, S. D., will vote whether to sell the city light and power plant to the Northwestern Public Service Company for $325,000.

Proposed sale of the electric light distribution system at Clarkfield, Minn., to the Northern States Power Company for $35,000 was defeated in a special election when the proposal failed to poll the necessary two-thirds majority.

The municipal electric light plant of Corydon, Iowa, has been sold to the Iowa Southern Utilities Company of Centerville for $87,000, the voters sanctioning the purchase by 439 to 56. The Bechtel interests of Davenport control the power company.

The Wisconsin Railroad Commission has authorized the Interstate Power Company to purchase the Wauzeka (Wis.) Light & Power Company, valued at $8,000.

Among the last orders issued by retiring members of the Illinois Commerce Commission at Springfield were one authorizing the Central Illinois Light Company to buy the entire electric utility property of the Deer Creek Power & Light Company for $13,500 and one authorizing the Illinois Power & Light Corporation to buy the properties of the Lomax Power Company for $5,000.

The Indiana General Service Corporation has filed a petition with the Indiana Public Service Commission asking permission to take over the property of the Sweetzer Rural Light & Power Company.

Voters of Oakley, Kan., will decide on September 10, at a special election, whether its municipally owned electric plant shall be retained or sold to the Central Kansas Power Company, which offers $125,000 for it.

Purchase by the Potomac Edison Company of a controlling interest in the Piedmont Electric Light & Power Company, serving 1,500 consumers in Piedmont, W. Va., and at Luke and Westernport, Md., is announced..

The Virginia Public Service Company has completed the purchase of the Leesburg (Va.) Electric Company.

The Central Power & Light Company has purchased the municipal electric light and power plant of Runge, Tex.

The citizens of Belleville, Ontario, on August 7 adopted a bylaw to raise $176,000 to purchase from the Ontario Hydro-Electric Power Commission the local distribution system.

The Electric Bond & Share Company announces that the deed to electric properties of the International Settlement in Shanghai, China, has been delivered to the Shanghai Power Company, a subsidiary of the American & Foreign Power Company organized for the purpose of acquiring these properties.

Congressman Taylor Protests Against Colorado Permits

Congressman Edward T. Taylor, of Glenwood Springs, Colo., maintaining that the Boulder Dam act, despite its proclamation by the President, will not be effective until after the contracts for power have been signed, is protesting vigorously against any action by the Federal Power Commission on pending applications, on the ground that to grant any of them would militate against the interests of the upper basin states.

"There are fifty applications for power pending," Mr. Taylor said last week at Denver, "and half of them are from Arizona. Utah has a large number and Colorado has only four of very minor size. The Southern California Edison Company has an application for 3,000,000 hp. in one permit and has three or four others pending.

"The Utah Power Company and other large power companies are likewise seeking immense power permits. If these are granted, the rights of our upper basin states will be sacrificed. The Federal Power Commission meets next month, and I suggest that the upper basin states should be represented at the meeting to protest against permits."

Briefer News

CALIFORNIA ELECTRICAL INSPECTORS WILL MEET IN SAN FRANCISCO.—The Southwestern Section of the International Association of Electrical Inspectors (formerly the California Association of Electrical Inspectors) will hold its annual convention at the Hotel Whitcomb, San Francisco, on September 18-20, instead of in Sacramento, as it had first intended.

ELECTRIC METER SHORT COURSE AT AMES, IOWA. — Iowa State College, Ames, will give its eleventh annual electric meter short course on September 17 to 20. This course, with a decade of experience to draw upon, is sponsored by the meter committee of the Iowa Section, N.E.L.A., and is conducted by the engineering extension service of the college.

RATES AT TEXARKANA, ARK., GO DOWN.—A reduction of 15 per cent in the domestic and commercial light rate and the installation of new types of rates which will mean an annual saving of $50,000 to the citizens of Texarkana, Ark., was recently announced by W. E. Bann, vice-president and manager of the Texarkana division of the Southwestern Gas & Electric Company. The rates are already effective.

OKLAHOMA CITY REGULATES MECHANICAL REFRIGERATION.—The Council of Oklahoma City has adopted an ordinance placing all multiple-refrigeration units under the supervision of the building commissioner, requiring a permit for each such installation and requiring dealers in them to be licensed by the city. This measure is intended to avoid danger of asphyxiation by methyl-chloride gas used in mechanical refrigeration. The law does not affect domestic users having only one unit.

ABERDEEN, WASH., WOULD CONDEMN DISTRIBUTION SYSTEM. — The City Council of Aberdeen, Wash., has authorized condemnation proceedings against the Gray's Harbor Railway & Light Company's distributing system in that city and has directed the city attorney to draw up an ordinance authorizing acquisition of the system.

MUNICIPAL PROJECT AT DELTA, COLO., DEFEATED.—By a vote of 266 against and 246 for, the voters of Delta, Colo., recently defeated a municipal electric project fostered by Charles Viestenz and associates of Loveland, Colo. In July, 1928, the city of Delta declined to renew the Western Colorado Power Company's franchise for another twenty years and since that time the power company has been supplying the city with light and power without a franchise.

PROPOSED RATE REDUCTIONS IN UTICA, N. Y.—Elimination of the penalty charge and a 12 per cent reduction in the present schedules for electricity to 31,805 residential consumers in the city of Utica is proposed by the Niagara-Hudson Power Corporation. These with the proposed changes in the commercial light and power rates will mean a saving of approximately $220,000 a year to Uticans, about $120,000 of which will be to residential consumers alone. The proposed reductions, made public by Floyd L. Carlisle at a mass meeting in Utica, if approved by the Council and the commission, will bring to an end the long-standing agitation for a reduction in the price of energy.

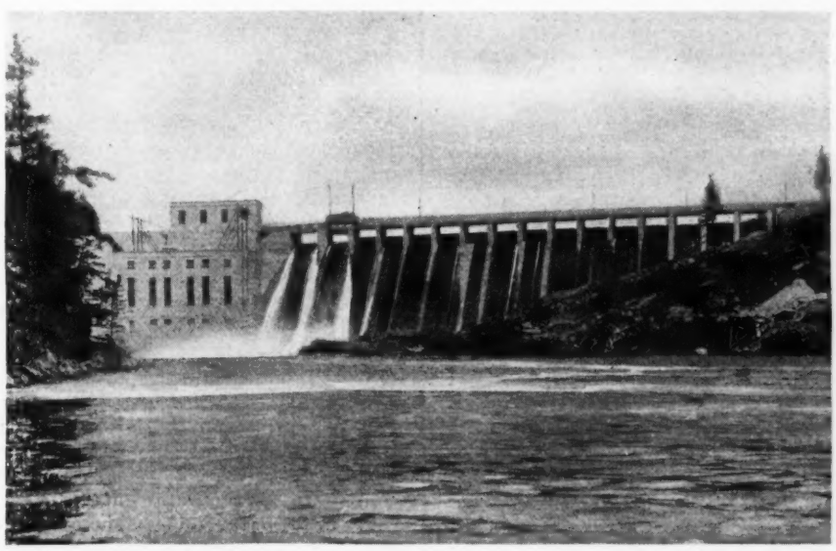
RAISING LAKE LEVELS IN NORTHERN MINNESOTA.—Passing on 129 claims, largely in the village of Warroad, Minn., appraisers appointed by the courts to determine damages which may result from the overflow of land by raising the level of the Lake of the Woods and other Northern boundary waters have awarded damages totaling $28,125. The amount is considerably less than that claimed, and it is expected that appeals will be taken. Proceedings were begun by the United States government, which is raising the lake levels to improve navigation and develop power. Part of the cost is to be borne by the Canadian government in accordance with the terms of a treaty.

EXPANSION OF KANSAS TRANSMISSION SYSTEM.—The United Power & Light Corporation of Abilene, Kan., has plans for the construction of a 66,000-volt steel-tower transmission line from the Tecumseh station of the Kansas Power & Light Company, near Topeka, through Manhattan, Junction City, Abilene and Salina to Hutchinson. This line will provide a more through tie-in between the Tecumseh plant and the various stations of the United Power & Light Corporation. A brick and steel building will be erected to house the hydro-electric plant at Rocky Ford and a 3,000-kw. synchronous condenser will be installed. The power plant at Junction City will be rebuilt and its capacity increased by installing two 1,000-hp. generating units.

IMPROVING SERVICE IN BROOKLYN, N. Y.—Several million dollars are being spent in improving electric service in the Borough of Brooklyn, N. Y., President M. S. Sloan of the Brooklyn Edison Company announces. This includes the removal of overhead lines from more than 70 miles of streets in outlying Brooklyn and running them underground, putting power networks and transformers in "subways" and changing direct-current installations to alternating current. The program has been under way since late in 1927, and the removal of overhead lines is expected to be completed this year. As little disturbance to traffic as possible is caused, only 7 miles of trenches being open at any one time.

NEW HIGH-PRESSURE STEAM TURBINE ORDERED FOR PARIS.—The Société d'Electricité de Paris has ordered from the Oerlikon company for the extension of its St. Denis power station a 57,000-kw. high-pressure steam turbine which marks an important advance in European steam-turbine design. It is, a correspondent reports, probably the first instance on that continent of the generation of such high power in a multi-cylinder set arranged on one shaft and running throughout at a speed of 3 000 r.p.m. The set will consist of high-

An International Border Hydro-Electric Plant



HYDRO-ELECTRIC development of the lakes and streams on either side of the Ontario-Minnesota border is a subject that has caused no little agitation in the state named. Above is a view of a recently completed hydro plant of the Ontario & Minnesota Power Company at Calm Lake, on the Seine River, in northern Ontario. This plant has an installation of 13,200 hp., and the power is transmitted to Fort Frances for use in the pulp and paper industry.

and medium-pressure elements and two low-pressure cylinders coupled direct to one 50,000-kw. alternator and an exciter, all mounted in line on a single shaft. During normal working conditions the steam pressure—measured immediately in front of the turbine—will amount to from 710 lb. to 850 lb. per square inch absolute, while the steam temperature will range from 842 deg. to 900 deg. F. In exceptional cases the turbine must be capable of withstanding a pressure of 995 lb. and a temperature of 932 deg.

EUGENE (ORE.) WILL SOON HAVE NEW MUNICIPAL PLANT.—The new hydro-electric plant being built by the city of Engene, Ore., at a cost of $1,500,000 will be placed in operation some time in November this year, according to the announcement of the Water and Power Board of that city. With the completion of the plant the municipality will not find it necessary any longer to purchase energy from the Mountain States Power Company during periods of heavy demand. The independent utility is furnishing approximately 1,300 kw. to the city, but the new plant will have an initial capacity of 6,500 kw. and with added equipment generate a maximum of 13,000 kw.

EQUALIZING RATES FOR HIGH-TENSION AND LOW-TENSION SERVICE.—The New York Public Service Commission has approved amendments to the tariffs of the Brooklyn Edison Company, New York Edison Company, New York & Queens Electric Light & Power Company and United Electric Light & Power Company for the purpose of limiting the use of high-tension service in order to increase service from low-tension networks. The addition of a special provision to each classification permits the rendition of service to those who might otherwise take it at high-tension rates at low-tension rates whch have been corrected to take care of the losses sustained by reason of a customer taking the service at high tension and providing his own transportation equipment.

SOUTHWESTERN OPERATING COMPANIES CONTINUE TO EXPAND.—Following the recent announcement by the American Commonwealth Power Company that its subsidiaries, the Southwestern Public Service Company and the Texas Utilities Company, will share in an expenditure of $15,000,000, it announced that the capacity of the Amarillo power plant of the Southwestern Public Service Company will be increased from 10,000 kw. to 20,000 kw. and may be increased to 25,000 kw. The company's plants at Roswell and Carlsbad, N. M., are now being enlarged. The transmission lines of the Southwestern Public Service Company and the Texas Utilities Company are interconnected at Canyon, Tex. The power transmission system of the companies in the Panhandle and South Plains of Texas and in eastern New Mexico is to be greatly extended.

COMPETITION BETWEEN COMPANY AND CITY AT HAMILTON, OHIO.—By reducing rates the Union Gas & Electric Company, Cincinnati, has, through a subsidiary, been seeking to acquire consumers of more than 600 kw.-hr. a month in Hamilton, Ohio, 12 miles from Cincinnati, where it competes with the municipal plant. In response the Hamilton City Council has announced an ordinance fixing a scale of rates for the municipal plant to coincide with those offered by its competitor. The new rates, according to R. P. Price, Hamilton's city manager, will reduce revenue by $8,454 a year. The Union Gas & Electric Company has not reduced rates to customers using 600 kw.-hr. a month or less. Those using from 450 kw.-hr. to 600 kw.-hr. have constantly been given the same rate of 5 cents from both the city and the company. Householders and other small consumers received a slightly lower rate from the city. Mr. Price asserts that the company has violated an oral agreement. The city put a new plant into operation the first of this year, and the installation of a unit to double its capacity is under way. The total cost of the plant will be more than $1,250,000.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue of July 6, page 46.]

International Association of Municipal Electricians—Statler Hotel, Boston, Aug. 20-24. H. N. Lang, box 1864, Orlando, Fla.

International Association of Electrical Inspectors, Western Section—Book-Cadillac Hotel, Detroit, Aug. 26-28. W. S. Boyd, 175 W. Jackson Blvd., Chicago. International convention, Vancouver, B. C., Canada, Sept. 9-11. F. D. Weber, P.O. box 745, Portland, Ore.

National Association of Railroad and Utilities Commissioners—Glacier National Park, Mont., Aug. 27-30. J. B. Walker, 270 Madison Ave., New York.

Rocky Mountain Division, N.E.L.A.—Hotel Colorado, Glenwood Springs, Colo., Sept. 2-4. O. A. Weller, Public Service Co. of Colorado, Denver.

Colorado Utilities Association—Glenwood Springs, Colo., Sept. 2-4. O. A. Weller, Public Service Co. of Colorado, Denver.

American Institute of Electrical Engineers—Pacific Coast convention, Santa Monica, Calif., Sept. 3-6. F. L. Hutchinson, 33 West 39th St., New York.

Pennsylvania Electric Association—Bedford Springs Hotel, Bedford Springs, Pa., Sept. 4-6. H. A. Buch, Telegraph Building, Harrisburg, Pa.

Association of Edison Illuminating Companies—Chateau Frontenac, Quebec, Sept. 9-12. P. S. Millar, 80th St. and East End Ave., New York.

New England Division, N.E.L.A.—Hotel Griswold, New London, Conn., Sept. 9-12. Miss O. A. Bursiel, 20 Providence St., Boston.

Empire State Gas and Electric Association—Electric Meter Section, New York Edison Auditorium, New York, Sept 12-13; annual meeting, Saranac Inn, Saranac Lake, N. Y., Sept. 19-20. C. H. B. Chapin, Grand Central Terminal, New York.

American Electrochemical Society—Hotel William Penn, Pittsburgh, Sept. 19-21. C. G. Fink, Columbia University, New York.

Illuminating Engineering Society—Bellevue-Stratford, Philadelphia, Sept. 24-27. A. B. Oday, 29 West 39th St., New York.

Great Lakes Division, N.E.L.A.—French Lick Springs, Ind., Sept. 26-28. T. C. Polk, room 110, 140 South Dearborn St., Chicago.

American Electric Railway Association—Atlantic City, Sept. 30-Oct. 4. J. W. Welsh, 292 Madison Ave., New York.

Association of Electragists International—New Ocean House, Swampscott, Mass., Sept. 30-Oct. 3. L. W. Davis, 420 Lexington Ave., New York.

National Safety Council—Stevens Hotel, Chicago, Sept. 30-Oct. 4. W. H. Cameron, 108 East Ohio St., Chicago.

National Electrical Manufacturers' Association—Wardman Park Hotel, Washington, Oct. 7-11. S. N. Clarkson, 420 Lexington Ave., New York.

ANOTHER UTILITY TAXATION BILL DEFEATED IN GEORGIA.—Failing to receive a majority vote of the Georgia House of Representatives, the Peterson bill, which would have imposed a tax of 2 per cent on the gross receipts of all public utilities corporations in the state, was defeated on August 6. The vote was 102 for to 75 against, but a majority of the House, 104 votes, was necessary for the measure to pass. Representative Peterson's original measure, as stated last week (page 293), called for a tax of 5 per cent on the gross receipts of all public utility corporations in the state. When announcement was made, however, that the Senate would pass no measure providing for a tax of more than 2 per cent, an amendment making the tax 2 per cent was accepted.

GRANITE FALLS, MINN., WILL TAKE UTILITY COMPANY ENERGY AND CANCEL MUNICIPAL BOND ISSUE.—After a controversy which brought about the resignation of Mayor Hans Cole, Granite Falls (Minn.) officials and the Northern States Power Company have signed a contract paving the way for construction by the company of a 20,000-kw. power plant at that place, to cost with the transmission system $2,500,000 and furnish power to Granite Falls and neighboring towns. Bonds had been sold by the municipality for $90,000 to make improvements in its municipal power plant. These will be canceled. The proposal to turn to the power company for the extra power needed originated with the city, which found the company ready to meet it half way.

DALHOUSIE (N. B.) PAPER MILL TO HAVE ELECTRIC DRIVE THROUGHOUT.—The International Paper Company's first newsprint mill in New Brunswick, Canada, now under construction in Dalhousie, will be electrically operated throughout with the most modern equipment. The plant is designed for four machines, but for the present will be limited to two. Most of the power required will be supplied from the Grand Falls hydro-electric development of the company, on the St. John River, 110 miles distant. This plant has an initial installation of three 17,500-kva. generators, and in the Dalhousie plant

two turbo-generator units will be installed to operate in parallel with the Grand Falls system. The steel-tower transmission line from Grand Falls to Dalhousie is designed for 132-kv., three-phase transmission. At the receiving end the lines tie into an outdoor substation equipped with two 18,000-kva. banks of transformers stepping down to 6,600 volts for distribution.

NEW JERSEY LEGISLATURE REPEALS ACT SAID TO FAVOR PUBLIC UTILITIES UNDULY. — Called into special session for the purpose by Governor Larson, the New Jersey Legislature on August 12 by large majorities in both houses repealed the Wise act, regulating the use by public utilities of bridges taken over by the State Highway Commission. It passed a bill which does not include the disputed retroactive feature of the original measure, and the new measure was signed immediately by the Governor. It provides that the act "shall not relieve any public utility from the payment of any sum now due or claimed to be due or accrued under any contract previously entered into by any such public utility for its use of any bridge or viaduct."

EDISON EDUCATIONAL PRIZE GOES TO YOUTH FROM WASHINGTON STATE.— Forty-nine youths, one from each state, selected by its Governor, and one from the District of Columbia, selected by its commission, took the examination at the Edison Laboratories for the four-year scholarship offered by the inventor to the winner. The contest and the questionnaire aroused great interest throughout the country. The winner was Wilbur B. Huston, sixteen years old, of Olympia, Wash., and he selected the Massachusetts Institute of Technology as the college where Mr. Edison is to pay his tuition fees for four years. Lesser scholarship awards were made to the four other boys who ranked highest in the opinion of a group of judges including, among others, Henry Ford, Charles A. Lindbergh and Dr. S. W. Stratton, president of the Massachusetts "Tech."

NORTH CAROLINA AUTHORITIES AND DUKE POWER COMPANY DISPUTE OVER TAX. — Representatives of the Duke Power Company were in Raleigh, N. C., recently to confer with A. J. Maxwell, commissioner of revenue, and Dennis G. Brummitt, attorney-general, relative to a tax of $80,000 to $100,000 which Commissioner Maxwell contends is due the state from the Duke company for the operations of the Southern Power Company (absorbed by the Duke Power Company late in 1927) during 1927 until it was absorbed. The conference indicated that there was little hope of the two groups getting together on the tax, the power company representatives claiming that it is not due, since it was a tax for continuing business, which that particular power company, in name at least, did not do. The state will probably take the case, which has aroused considerable public interest in North Carolina, to the courts.

Recent Court Decisions

COURT REFUSES TO FORCE COMPANY TO FURNISH SERVICE IN CASE WHERE DELINQUENT CUSTOMER MAKES COUNTERCLAIM OF MONEY DUE.—A dispute over $7 alleged by a customer (Bailey) of the Interstate Power Company to be due him from the company for printing done, and which he wished to set against his power bill, led the company to refuse further service. The Supreme Court of Iowa held that an injunction sought to restrain the company from further refusal was properly denied. (225 N.W. 861.)*

WHETHER COMPANY WAS NEGLIGENT IN NOT RESTORING INTERRUPTED SERVICE QUICKLY IS FOR JURY.—In Kier Preserving Company vs. West Bend Heating & Lighting Company the plaintiff sought damages because of loss arising from the interruption of electric service and delay in restoring it, notwithstanding assurances from the lighting company's employees. The Supreme Court of Wisconsin held that it was for the jury to decide whether the dilatoriness complained of constituted negligence, though it pointed out that the defendant was not an insurer of continuous service, uninterrupted by conditions beyond its control, if it exercised reasonable care, foresight and diligence so to construct, maintain and operate its plant as to prevent such interruption as far as practicable. (225 N. W. 200.)

POWER PLANT NOT FORFEITABLE BECAUSE OF USE IN ILLICIT DISTILLATION. — The United States Circuit Court of Appeals has determined, in Kohler Company vs. United States, that the national prohibition act does not authorize the forfeiture of an electric lighting plant connected by wire with a building in which illicit distillation is carried on. The plant in question was sold conditionally to an elk-breeding association, installed in a farm building and, unknown to the seller, in whom title was still vested, was connected with the distillery to supply light and power. The District Court had held that the plant was subject to forfeiture, but the superior tribunal said that such a broad interpretation of the law would cover even the plant of a great public service corporation, with thousands of customers, provided energy for the illicit manufacture of liquor was obtained from such a plant.

PUBLIC SERVICE COMPANY NOT EXEMPT FROM TAXATION ON DIVIDENDS FROM SECURITIES OF OWNED COMPANY.—In a suit of the Wisconsin Public Service Corporation against the Wisconsin Tax Commission the company sought exemption from income taxation on dividends paid it on the stock and bonds of the Menominee & Marionette Light & Traction Company, all of which are owned by the Wisconsin Public Service. The plaintiff claimed that this income was exempt under the provisions of the law which exempts from income taxes "incomes derived from property and privileges by persons now required by law to pay taxes or license fees directly into the treasury of the state in lieu of taxes." The Wisconsin Supreme Court denied this contention, saying: "The service company owned no interest whatever in the property belonging to the traction company. The title to the property was securely vested in the traction company. It was assessed to, and the taxes thereon were paid by, the traction company. The earnings belonged to the traction company until paid out to stockholders in the form of dividends. It is conceded that any person other than a public utility would be subject to an income tax upon such dividends. Because the plaintiff is a public utility and pays taxes upon property owned by it into the state treasury, it is not for that reason exempt from paying an income tax upon property which is not so assessed."

CHANGE IN PLACE WHERE WATER POWER IS USED DOES NOT NECESSARILY VITIATE RIGHT OF USE.—In State ex rel. Van Winkle vs. People's West Coast Hydro-Electric Corporation it was held by the Supreme Court of Oregon that the company's right of appropriation was not defeated by its failure to file map of definite location on completion of pipe line, that since it had completed its plant and diverted water to the place of present use three years before the state acquired any legal right to use the waters, the state could not complain because of a change in the place of use, and that where difficulties in constructing pipe line arise the appropriator of water may temporarily use it to operate another plant without abandonment of its right of appropriation (278 Pac. 583.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

MUNICIPALITY FORBIDDEN TO ACQUIRE GENERATING PLANT SINCE IT WAS UNDER CONTRACT TO BUY ENERGY. — The New York Public Service Commission has refused to allow the village of Tupper Lake to operate a generating plant to be built for it by the Low Power & Light Company, because it had an outstanding contractual obligation to take energy from the Paul Smith's Electric Light & Power & Railroad Company. The commission also, in an application connected with the foregoing one, refused to authorize the construction or operation of transmission lines in small communities which were part of a general plan of hydro-electric development where the central part of the project had been disapproved by the Supreme Court of the state.

INDETERMINATE-PERMIT LAW BINDS WISCONSIN MUNICIPALITIES.—The Wisconsin-Michigan Power Company has an indeterminate permit to serve the town of Vanden Broek. According to an agreement between the company and the city of Kaukauna, operating an electric system, the latter was permitted to serve part of the town. Certain residents in the remaining part also asked for city service; the city, in accordance with its agreement, refused to extend service and the residents complained. The Wisconsin Railroad Commission has ruled that Kaukauna, operating outside of the corporate limits, was in the same position as a private plant and therefore could not render service in Vanden Broek without the express permission of the company which held the permit for that section.

News About Men of the Industry

R. S. Fleshiem Assumes New Duties

R. S. Fleshiem has been appointed manager of the electrical department of the Allis-Chalmers Manufacturing Company, Milwaukee, succeeding J. R. Jeffrey, resigned. Mr. Fleshiem was graduated from the University of Michigan in 1904 and immediately thereafter entered the Allis-Chalmers student apprentice course at Bullock Works, Norwood, Ohio. He served successively in the Bullock Works sales department, the Cincinnati, Detroit and Chicago district offices and was manager of the Cleveland office from October, 1913, until September, 1917. After spending a year and a half in the army during the World War, he went to Milwaukee in April, 1919, as assistant manager of the electrical department.

EDWARD I. PRATT, advertising manager of the Bryant Electric Company, has resigned to affiliate himself with the Curtiss Flying Service, which is the sales unit of the Associated Curtiss Companies.

W. H. FRANCIS, for many years head of the purchasing and inter-service bureau of the Edison Electric Illuminating Company of Boston, has retired from active duty after 37 years' service with the company.

GEORGE H. SANDER has been appointed industrial engineer of the Public Service Company of New Hampshire, with headquarters at Manchester. His post as merchandising manager has been filled by T. E. HARVEY. Mr. Sander is widely known in New England utility commercial circles and has for some time been active in the National Electric Light Association in the Northeast.

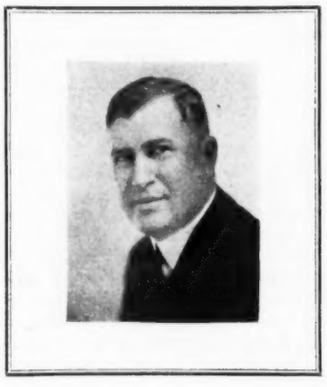
FRANK B. STEELE, who resigned recently as vice-president and general manager of the Utica Gas & Electric Company, was tendered a testimonial dinner at the Yahundasis Golf Club on the night of August 6 by 30 of his friends. They took this means of expressing their admiration for his untiring efforts in behalf of the many undertakings in which he was identified for the betterment of Utica.

LEONARD L. ELDEN, technical adviser to the general superintendent of the Edison Electric Illuminating Company of Boston, was the recipient of the honorary degree of doctor of science from Tufts College, Medford, Mass., at the recent commencement exercises. From 1901 to 1927 he was superintendent of the company's electrical engineering department and he has long been active in the fields of interconnection, system planning and international standardization. Mr. Elden was a member of the World Power Conference Committee and of late has done much work in connection with the improvement of fractional-horsepower motor designs as related to power company service standards.

PETER SCOTT, JR., has been named manager of the Iowa Electric Company at Cumberland, Ia.

W. R. Emerson New Chairman of Accounting National Section

W. R. Emerson, who was appointed chairman of the Accounting National Section of the National Electric Light Association, has been identified with the public utility industry in Oklahoma for almost twenty-five years. He entered the employ of the Muskogee Gas & Electric Company in 1905 and, advancing through the ranks, he served successively as cashier, general bookkeeper and auditor and in the spring



of 1917 he was promoted to the position of assistant manager. Several months later he was transferred to Oklahoma City and made secretary, treasurer and general auditor of the Oklahoma Gas & Electric Company. In this capacity he has taken an active part in the development of the utility accounting system of the Byllesby Engineering & Management Corporation of Chicago, this company being the management corporation for the Oklahoma Gas & Electric Company.

From December, 1917, to April, 1918, he served in Washington as a dollar a year man in the reorganization and decentralization of the American Red Cross. He has taken an active part in the work of the Accounting Section of the National Electric Light Association since the geographic divisions were first started, serving on various committees. In 1925-1926 he served as chairman of the accounting section of the Southwestern Geographic Division, later being made a vice-chairman of the National Accounting Section, in which capacity he served from 1926 to 1929.

J. R. Jeffrey Retires

J. R. Jeffrey, manager of the electrical department of the Allis-Chalmers Manufacturing Company, Milwaukee, has resigned and is retiring after twenty-eight years of service with the company. Mr. Jeffrey served an apprenticeship of two years with the Polson Iron Works, Toronto, on engine and boiler work. He was with the Canadian General Electric Company at Peterboro for six years, becoming chief draftsman after the first year. He also served as chief draftsman for the Lachine Rapids Hydraulic & Land Company, Montreal.

In 1901 he entered the employ of the Bullock Electric Manufacturing Company, Norwood, Ohio, as assistant manager of sales and later became assistant secretary. In 1908, after Allis-Chalmers had taken over the Bullock company, he was transferred to Milwaukee as assistant manager of the steam and electrical department, and in 1914, when the department was divided, he became manager of the electrical department, which position he has since held.

Mr. Jeffrey plans to take a much-needed rest and is leaving for his summer home at Stony Lake near Peterboro, Ontario.

OWEN D. YOUNG, chairman of the board of directors of the General Electric Company, was voted to be "the greatest business man in America" by 200 business men from 27 states and three foreign countries who are enrolled at the Harvard Business School summer session.

RALPH O. WALTHAM, for the past seven years assistant engineer in the gas and electric division of the engineering department of the California Railroad Commission, has resigned to become managing editor of *Electric Light and Power*, Chicago. Mr. Waltham's connection with the electrical industry in California began in 1908 with the firm of New York engineers which built the Big Bend plant of the Great Western Power Company in Plumas County. Since that time he has been affiliated in turn with the Livermore Water & Power Company and the Pacific Gas & Electric Company.

ART CHURCH, since 1920 district manager at Santa Maria, Calif., for the San Joaquin Light & Power Corporation, has been made sales engineer, succeeding T. K. HOLMES, who resigned to become sales manager of the Yosemite Portland Cement Company. Mr. Church will specialize in oil-field installations and will divide his time between Fresno, the oil fields in the San Joaquin territory and Los Angeles. He will be replaced in Santa Maria by G. V.

Footman, formerly district manager at Coalinga. J. C. BERRY, since 1925 assistant district manager, has been promoted to district manager.

O. Z. TYLER, for many years superintendent of electric plants at Jacksonville, Fla., has been promoted to the post of general superintendent of utilities for that city.

E. O. HOWARD, president of the Utah Light & Traction Company, Salt Lake City, was elected president of the local Chamber of Commerce at a recent meeting of the board of governors held June 17. Mr. Howard is serving his third year as a member of the board.

FRANK M. GENTRY, formerly assistant to the mechanical engineer of the New York Edison Company and for many years principal assistant engineer with George A. Orrok, consulting engineer, has resigned from the New York Edison Company to join the staff of Lehman Brothers, bankers, New York City.

FRANK T. HITCHCOCK, purchasing agent of the Edison Electric Illuminating Company of Boston, has been appointed superintendent of the purchasing and inter-service bureau, succeeding W. H. Francis. Mr. Hitchcock entered the employ of the company in 1926. W. F. STEVENS, superintendent of the supply department, has been made assistant superintendent of the purchasing and inter-service bureau.

DANIEL TORRANCE, formerly secretary to A. W. Leonard, president Puget Sound Power & Light Company, Seattle, has been made assistant to the president. Mr. Torrance has been associated with Stone & Webster interests for fifteen years and went from Boston to Seattle about four years ago to take the position of assistant comptroller Puget Sound Power & Light Company.

L. G. MCCLELLAN, for the past four years purchasing agent for the Grays Harbor Railway & Light Company, Aberdeen, Wash., has become secretary and assistant treasurer of the Grays Harbor company and officer in its subsidiaries. In addition to his new duties he will retain his position as purchasing agent. Mr. McClellan succeeds G. B. SANFORD, who has resigned to become treasurer of the *Business Chronicle* in Seattle.

GLENN L. JACKSON, for the past two years sales manager for the Mountain States Power Company, has been made sales manager for that company and the California-Oregon Power Company. J. J. BUCHTER and H. L. BROMLEY, merchandise manager and advertising manager, respectively, for the California-Oregon Power Company, now hold those positions for both companies.

L. W. GROTHAUS, assistant manager of the electrical department of the Allis-Chalmers Manufacturing Company, has been transferred from the company's Bullock Works at Norwood, Ohio, to Milwaukee, succeeding R. S. FLESHIEM, who has been made manager of the department. Mr. Grothaus has been in the employ of the company for over twenty-five years. Receiving his shop training at Bullock Works, in 1908 he was transferred to the power and electrical department at Milwaukee. In 1912 he joined the Milwaukee sales office, remaining there until the fall of 1917, when he entered government service at Washington in connection with the War Industries Board. At the termination of that service, in January, 1918, he rejoined the Milwaukee sales staff and in July of that year was transferred to Minneapolis in charge of that office. Subsequently he was made manager of the Cleveland district office and in April, 1925, was appointed assistant manager of the electrical department located at Bullock Works. For the past three years Mr. Grothaus has served as chairman of the motor and generator section of the National Electrical Manufacturers' Association.

D. MCFARLAN MOORE, past vice-president of the Illuminating Engineering Society and well known as one of the earliest pioneers in gaseous conduction, and particularly as the inventor of a television lamp, has been elected a member of the Lehigh Chapter of the Society of the Sigma Xi, which is a national honorary scientific fraternity.

WILLIAM G. MARSHALL, since 1926 director of personnel for the Philadelphia Company and affiliated corporations, has been appointed assistant to vice-president T. P. Gaylord of the Westinghouse Electric & Manufacturing Company. Mr. Marshall will be in charge of employee relations, but no change is contemplated in the existing positions of director of personnel or manager of employee service, according to an announcement made by Mr. Gaylord.

WALDO W. SKUSE has been appointed agriculturist for the Washington Water Power Company, Spokane, to consult with farmers on farm electrification throughout the territory served by the company in eastern Washington and northern Idaho. Mr. Skuse, a graduate of Washington State College in civil engineering and agriculture, has served at Spokane, Wash.; Helena, Mont., and Lewiston, Idaho, and for the past five years has been engaged in the farm equipment business in Lewiston and Walla Walla.

WENDELL L. WILLKIE, member of the law firm of Mather, Nesbitt & Willkie, Akron, Ohio, counsel for the Northern Ohio Power & Light Company, will leave the Akron firm October 1 and join Weadock & Willkie, with offices in New York City. The Weadocks are general counsel for the Allied Power & Light Corporation, which operates public utility properties in Ohio, Illinois, Indiana, Michigan, Tennessee and Pennsylvania. Mr. Willkie has made a distinguished record in the corporation law field since he first went to Akron ten years ago, direct from army service. He first entered the legal department of the Firestone Tire & Rubber Company and a year later went into the offices of Mather & Nesbitt. Mr. Willkie is the second member of the Northern Ohio Power staff to be drafted recently by the Allied Power & Light Corporation. In June M. W. ARTHUR, manager of commercial distribution, removed to New York to join the engineering and operations staff of the Allied organization.

Obituary

Alfred H. Cowles

Alfred H. Cowles, metallurgist and inventor and president of the Electric Smelting & Aluminum Company, Sewaren, N. J., died August 13. Mr. Cowles with his brother, Eugene H., developed the electric furnace in connection with producing aluminum and alloys. In 1885 the Electric Smelting & Aluminum Company was organized and two years later a British subsidiary was formed. Mr. Cowles had headed the former company since 1895. He was the recipient of many honors in recognition of his scientific discoveries. The Franklin Institute awarded him the Elliot Cresson and John Scott legacy medals in 1886, and the Paris Exposition of 1889 presented him with a gold medal. He was a fellow of the American Institute of Electrical Engineers and a member of the American Electrochemical Society, of which he had been vice-president; the American Institute of Mining and Metallurgical Engineers and the Franklin Institute. He was a native of Cleveland, Ohio, and received his education at Ohio State University and Cornell.

ROBERT M. SAXBY, well known as head of the purchasing department of the Ontario Hydro-Electric Power Commission, died at his home in Toronto, August 9, after a month's illness. For 20 years Mr. Saxby was prominently identified with the activities of the provincial power commission He was 57 years of age.

WALTER B. SNOW, for 22 years head of the engineering and industrial advertising agency known as Walter B. Snow & Staff, Boston, Mass., died at his home in Falmouth, Mass., Aug. 9 at the age of 69. Mr. Snow was graduated in mechanical engineering from the Massachusetts Institute of Technology in 1882 and for 25 years was employed in the engineering department of the B. F. Sturtevant Company, Boston. In 1907 he established his business at Boston as a publicity engineer, specializing in technical advertising. He severed his connection with the organization at the beginning of the present year on account of ill health.

Financial and Statistical News

TEMPORARILY at least, the utilities have resigned their market leadership. Many of the common stocks have made substantial recovery from the heavy losses incurred in last week's selling movement. The great majority, however, are still well below their recent high marks. This includes issues that were the most aggressive during the past few weeks. The effect of the recent attack upon utilities in the Chicago market seems to be still in evidence.

——How far the utility prices are likely to go is a question frequently asked. Many of the standard issues are today well over 30 times earnings. Active issues selling below twenty times earnings are difficult to find. The investing public has a larger and larger amount of available funds and is impressed with the desirability of utility common stocks more and more. Obviously their standard of value is an ever-changing quantity, and the old standards were long ago meaningless.

Central West Public Service Issues Notes

The Central West Public Service Company made an offering of three-year 7 per cent gold notes, amounting to $1,000,000, at 99¾ and interest yielding over 7 per cent. This company owns and operates public utility properties in Iowa, Minnesota and South Dakota, with other utility properties in Nebraska and North Dakota owned through subsidiaries.

The Convertible Bond

Referring to the recent disposition of utilities and other corporate enterprises to issue convertible bonds, the current market letter issued by Stone & Webster and Blodget says:

"Since the beginning of this year a large proportion of all new bond issues have carried convertible features. The convertible bond is not, however, of recent origin, as the first issue was offered over a half century ago. The reason for its popularity has been the fact that it constitutes not only an obligation but also a claim on the equity in the issuing corporation, and so the holder is at the same time both a creditor and a part owner. It is, however, essential for the buyer of convertible bonds to be certain that he is obtaining the full benefits of both these positions. On the one hand he should assure himself that as a present bondholder he is attaining the full advantages of a sound bond such as safety of principal and assurance of income. The buyer of convertible bonds should also consider his position as a prospective stockholder when he has availed himself of his conversion privilege, which is after all a call on the stock of the issuing company. It is important for him to be certain that the terms of the contract in respect to class of stock, ratio and time of conversion will grant a liberal participation in the future earnings of the issuing corporation.

"In all the history of the bond market the present time offers the investor the most favorable opportunities in convertible bonds for combining both the advantages of maximum safety of principal and income together with attractive possibilities of sharing in the profits of strong and successfully managed companies, which are issuing these securities not because of any inherent weakness in credit but to carry out nation-wide plans of industrial expansion."

Commonwealth Power Reduces Directorate.—As over 95 per cent of the common stock of Commonwealth Power Corporation is owned by the Commonwealth & Southern Corporation, it was deemed advisable to simplify the corporate organization of the former company, and at the annual stockholders' meeting in Portland, August 6, the board of directors was reduced from 21 to 7 members and the following were elected: W. H. Barthold, New York; C. M. Clark, Philadelphia; B. C. Cobb, Jacob Hekma, T. A. Kenney, Thomas W. Martin and H. S. Scarritt, all of New York City.

Montana Power Issue Oversubscribed.—A new issue of 50,000 shares of $6 preferred stock of the Montana Power Company offered locally on July 22 was heavily oversubscribed. This stock was offered at $100 per share to the people of Montana and outside of a booklet mailed within the state the offering was not publicly advertised. The $5,000,000 obtained will be spent for additional power generating equipment for the company.

The World's Electrical Energy and Industrial Progress*

CENTRAL stations of the world generate around 175,000,000,000 to 200,000,000,000 kw.-hr. of electricity each year. About 70 per cent of this is used by industries; that is, about 125,000,000,000 kw.-hr., or 175,000,000,000 horsepower-hours. The United States accounts for slightly over half of this. Other countries with appreciable generation are Germany, Canada, Great Britain, France, Japan, Italy, Switzerland, Norway, Sweden, Belgium.

In Switzerland, where some 900 kw.-hr. per annum per capita is generated, they have to go to France to find a market for surplus energy. About 99.8 per cent of Switzerland's total electrical energy, by the way, is generated from water power, but Switzerland is full of mountains that are full of rivers full of falling water: no need of any great investment per kilowatt in transmission lines there to conduct power to consuming centers.

It is no surprise, therefore, that Swiss industries are well electrified. Statistics group light, power and heat as taking 50 per cent, railways 12 per cent and chemical and metallurgical processes 23 per cent. The remaining 15 per cent is exported. The total industrial consumption is about 70 per cent; power and industrial lighting and heating together, therefore, account for 47 per cent. The total production runs around 3,600,000,000 kw.-hr. per year.

Japan presents considerable of interest in this connection. Though Japan was progressive and rapidly modernizing itself prior to 1923, the great earthquake of that year, with the resulting necessity of reconstruction, led to the equipment of many factories along modern lines that would otherwise still be only prospective. Then, too, Japan is growing as an industrial nation much beyond the average conception. Many important commodities that were totally imported ten years ago are now represented by only stray import shipments.

Japanese water power has been developed because of the high cost of coal there. About one and one-half million kilowatts of water power are now developed; something like eight million remain untouched. Combine these facts with prevailing cheap labor and long hours; the result can be only expectation of continued increase in industrialization.

The chief industries of Japan are weaving and dyeing, iron founding and mechanical work, chemicals, mining and refining and the preparation of

**From an address by Marshall T. Jones, chief electrical equipment division, Department of Commerce.*

food and drinks. In these five groups about 200,000 motors are now in use; all the other industries use 50,000. Their horsepower totals 1,500,000; others, 2,000,000. During the past ten years the increase has amounted to about 1,500,000 hp., a 75 per cent increase. That could happen only in a growing industrial country, and only when that country has abundant power supply developed through the medium of electricity.

Australia presents another angle, in that it is a pastoral and mining country, and manufacturing is not at present a great item among the resources of the Commonwealth. Mining and the industries allied with sheep and cattle raising, such as refrigerating works, canning, tanneries, show factories and woolen mills, are the largest users of electric power. It should be noted that in many instances the manufactured products of one industry are the raw materials of another, so that any statistics tend to make manufacturing in Australia appear to be more important than it really is.

Tasmania, however, has had a different experience from Australia as a whole. In the island state water power is plentiful, and as a result industry has grown there to a degree far beyond that experienced on the Australian mainland. In this instance there is a clear picture of the effect power development has had on industrialization. It requires no great insight to realize what a different history the uninhabited jungle territory of the north of Australia would have had if power, either in the form of fuel deposits or in rivers, had been found there in abundance, together with raw material supplies.

Generally speaking, France, Spain and the United Kingdom are our best European markets for industrial electrical appliances. Rather a large proportion of our exports of accessories and parts for motors go to Belgium and Italy, and even Norway imports a good deal of this equipment, while of our shipments of small motors a large percentage finds its way to Germany. The Netherlands, Sweden, Switzerland, Italy and Belgium also import small motors to a considerable extent. Trade with Russia is steadily improving.

GENERAL PUBLIC SERVICE ASSET VALUE UP.—The General Public Service Corporation reports an asset value of common stock as of July 31, 1929, of $59.82 per share. This compares with $50.06 reported as of June 30, 1929, and $23.67 per share for July 31, 1928. Large holdings of American Superpower, American Telephone & Telegraph, Commonwealth Edison, Detroit Edison, Middle West Utilities and U.G.I. have caused this rapid rise owing to their steady appreciation.

Utility Stocks Continue Upward Trend

Much has been said pro and con in the way of justifying the steady upward climb of utility stocks to levels more or less entirely out of keeping with the earning capacity of the stocks. In view of the recent heavy selling movement occasioned by the rise in the Federal Reserve rediscount rate, the following comparison of the averages of ten more or less representative public utility issues as of August 1 this year and the three previous years is of interest. The average of the ten stocks has increased by more than 132 per cent in the four years studied, and by far the larger part of this rise occurred during the past year

Trend of Ten Representative Utility Stocks

August 1:	1926	1927	1928	1929
Columbia Gas & Electric	85	96	112	230*
Commonwealth Edison	136	153	184	370
Consolidated Gas (Baltimore)	52	60	82	137
Detroit Edison	137	149	195	354
Edison of Boston	229	243	279	404
Middle West Utilities	115	111	143	401
Northeastern Power	20	18	25	78
Pacific Gas & Electric	130	150	192	75
Southern California Edison	31	36	48	76
Southeastern Power & Light	28	37	50	132
	96	105	131	226

*Corrected on account of 2½ for one split.

HARTFORD ELECTRIC TO INCREASE STOCK.—The Hartford Electric Light Company, Hartford, Conn., held a meeting of directors July 23 and voted an increase in capital stock from $18,000,000 to $21,000,000, subject to the approval of stockholders. It is recommended that the increase be covered by a new stock issue, one share for each six now held. Increased earnings of the company for the first half of 1929 are ample to take care of the dividend requirements of the proposed $3,000,000 issue, although no half-year financial statement is issued. The funds from the new stock issue if approved will be used for the needs of the ever-expanding system and to extend existing lines.

Pennsylvania Utility Increases Stock

Stockholders of the Luzerne County Gas & Electric Corporation, at a meeting held August 7, voted to change the capitalization from 30,000 shares of no par value, $7 dividend, first preferred stock, to 60,000 shares no par value, first preferred stock. The 176,694 shares of no par value common stock will remain unchanged.

The first preferred stock is to be divided into 30,000 shares of $7 stock, callable at $105, and 30,000 shares of $6 stock, callable at $105. The $6 dividend preferred shares will be sold primarily to gas and electric customers of the company.

Current Earnings Reports of Electric Light and Power Companies

	1929	1928	Per Cent Increase	Operating Ratio 1929	Operating Ratio 1928
American Water Works & Electric & subs. (Year ended June 30)					
Gross earnings	$52,208,685	$49,863,070	4.5	50	53
Net earnings	25,817,496	23,719,436	8.8	..	..
Commonwealth Power (Year ended June 30)					
Gross earnings	61,567,337	55,650,478	10.6	51	52
Net earnings	29,943,015	26,379,382	13.5	..	..
Consumers Power (Year ended June 30)					
Gross earnings	32,441,465	28,423,804	14.1	49	50
Net earnings	16,437,512	14,010,616	17.2	..	..
Engineers Public Service & subs. (Year ended June 30)					
Gross earnings	42,429,582	30,285,477	40.0	57	60
Net earnings	18,038,494	11,989,813	50.0	..	..
Milwaukee Electric Railway & Light (Year ended June 30)					
Gross earnings	30,918,343	28,037,267	10.2	67	68
Net earnings	10,112,781	9,086,520	11.1	..	..
Nebraska Power (Year ended June 30)					
Gross earnings	5,653,509	5,080,773	11.0	51	53
Net earnings	2,767,860	2,403,458	15.0	..	..
Pacific Power & Light (Year ended June 30)					
Gross earnings	$4,785,066	$4,071,817	18.0	52	56
Net earnings	2,276,967	1,772,421	28.0	..	..
Penn Ohio Edison } Northern Ohio Power } — (Year ended June 30)					
Gross earnings	28,802,052	26,741,226	7.7	60	61
Net earnings	11,597,606	10,169,020	14.0	..	..
Portland Electric Power (Year ended June 30)					
Gross earnings	12,637,733	12,303,415	2.7	59	59
Net earnings	5,144,924	5,022,108	2.4	..	..
Texas Power & Light (Year ended June 30)					
Gross earnings	9,612,019	9,513,151	1.0	50	55
Net earnings	4,757,779	4,286,643	11.0	..	..
United Light & Power & subs. (Year ended June 30)					
Gross earnings	92,106,058	86,628,518	6.3	58	61
Net earnings	38,406,371	33,713,645	13.9	..	..

Manufacturing Operations Decrease During July

MANUFACTURING activity in the country as a whole during July recorded a drop of slightly more than normal proportions for this season of the year, consumption of electrical energy by manufacturing plants indicates. The July rate of operations, not corrected for seasonal variation, but corrected for number of working days, was about 4.6 per cent under June. Contrasted with the same month last year the rate was 7.3 per cent greater. This brings the average rate of manufacturing activity for the first seven months of 1929 to a point 12.7 per cent higher than that established in the like period last year.

The index of activity in general industry, based on consumption of electrical energy, stands at 129.0 for July, as compared with 135.2 in June and 120.2 in July last year. The average for the first seven months is 135.1 as against 119.9 in the same time last year.

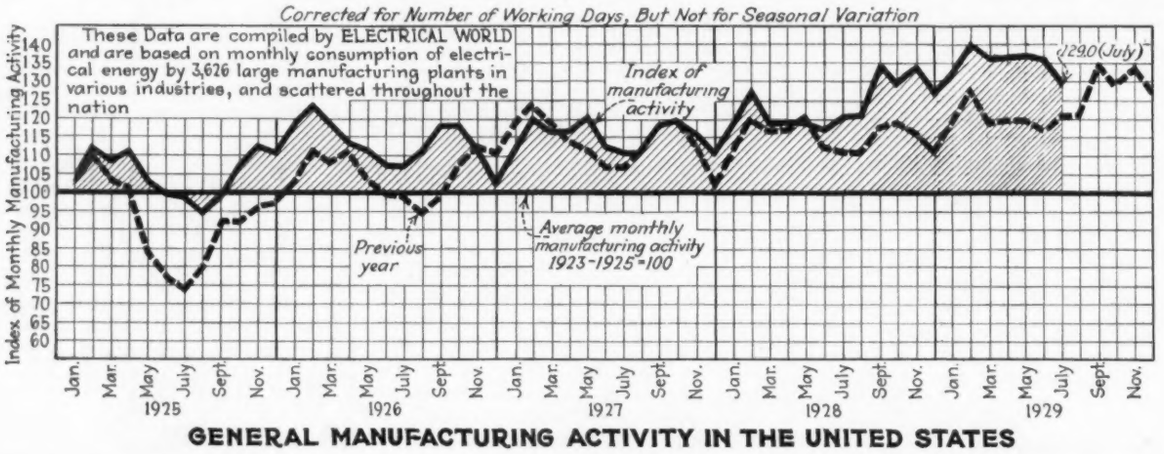
All sections of the country, except the Mountain-Pacific States, reported material drops in rate of operations as compared with June, but every section reported July operations on a plane materially over those of July last year. The Western States reported the largest gain over last year with 18.2 per cent, New England States 10.8 per cent, Middle Atlantic States 10.0 per cent, North Central States 8.0 per cent and the Southern States 0.7 per cent.

The automobile industry, including the manufacture of parts and accessories, reported a drop in July as contrasted with June of about 9.4 per cent, but was operating at a rate 2.9 per cent under July last year. This is the first time since September, 1927, that the rate of operations in any one month has fallen below that of the same month in the year previous. The rate of operations during July were 18.2 per cent under the peak of activity recorded during April.

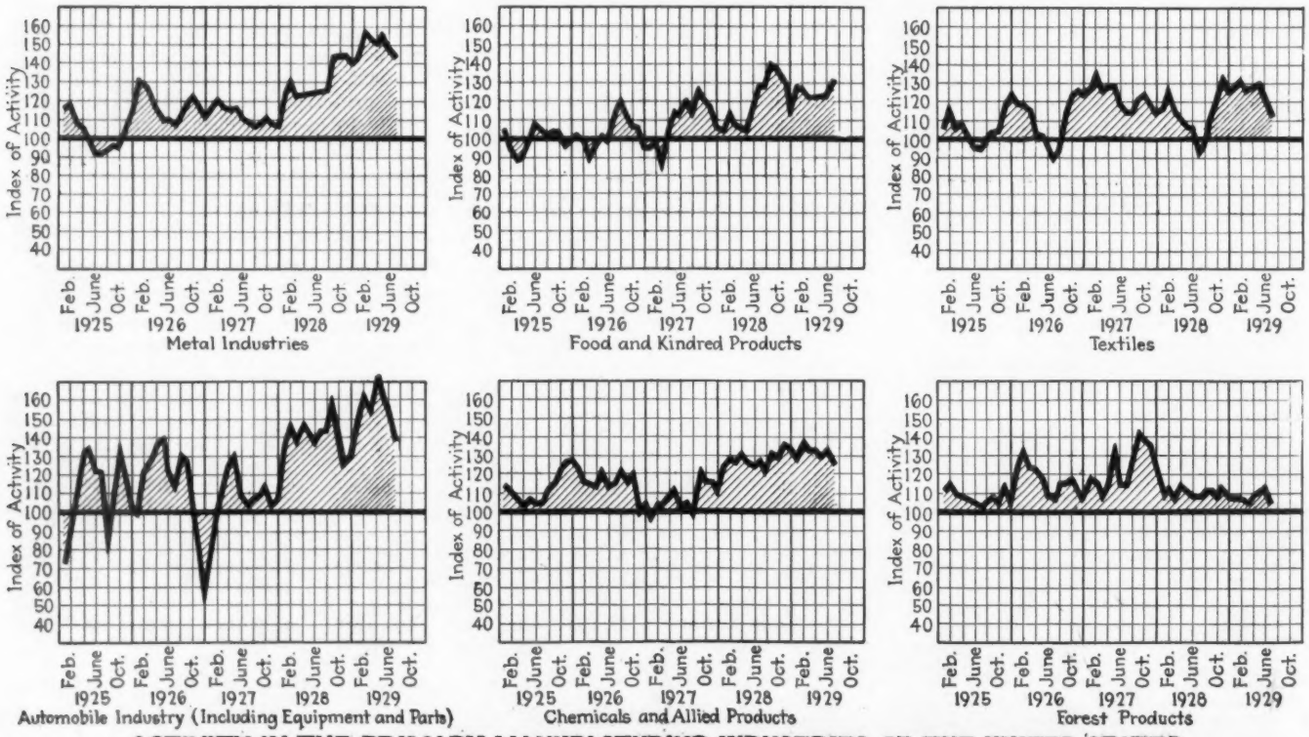
The rolling mills and steel plants recorded a drop of 6.4 per cent compared with June of the current year, but operations were still on a plane fully 16.1 per cent over July, 1928. The ferrous and non-ferrous plants reported a rate of activity practically on a level with that of June, but 12.3 per cent over July last year.

July operations in the textile plants of the country were 7.8 per cent under June, but 23.5 per cent over July last year.

The food products industry is the only manufacturing group reporting increased operations during July as compared with June, the recorded increase being 6.7 per cent. The current operations in this group were practically on the same plane as during July last year.


Corrected for Number of Working Days, But Not for Seasonal Variation
These Data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,626 large manufacturing plants in various industries, and scattered throughout the nation
Index of manufacturing activity
129.0 (July)
Previous year
Average monthly manufacturing activity 1923-1925=100
Index of Monthly Manufacturing Activity
1925
1926
1927
1928
1929

GENERAL MANUFACTURING ACTIVITY IN THE UNITED STATES



ACTIVITY IN THE PRIMARY MANUFACTURING INDUSTRIES OF THE UNITED STATES

Business News and Market Conditions

Federal Trade Commission Investigates Sales

The Federal Trade Commission now is making a comparative check of the cost, price and profit on merchandise sold at fixed resale prices and similar products on which there are no established prices. From a list of several hundred articles the commission has selected a representative group for the purpose of this study, which is intended to reveal the actual result in the conduct of business of the application of fixed resale prices on trade-marked and branded merchandise.

The findings on this phase of the commission's investigation of the resale price maintenance practice will be included in the second section of its report to Congress. The first part of the commission's report, which was submitted just prior to the adjournment of Congress last spring, presented the opinions of distributors and consumers with respect to resale price maintenance.

The canvass made by the commission indicated that wholesale and retail merchants are generally in favor of resale price protection and that the purchasing public, which was represented for the most part by farmers, is opposed to it. Representative Kelly of Pennsylvania has reintroduced his bill to legalize resale price maintenance contracts between manufacturers and distributors of trade-marked or branded merchandise, but the House committee on interstate and foreign commerce will not be organized for the consideration of pending legislation until the December session.

The prospect is that the bill will remain on the shelf, although its proponents anticipate that it will be favorably reported to the House.

Fixture and Lamp Production Shows Slight Decrease

The establishments engaged primarily in the manufacture of gas and electric fixtures, lamps, lanterns and reflectors in 1927 reported products valued at $127,802,407, a decrease of 1.5 per cent as compared with $129,698,389 reported for 1925, the last preceding census year. "Lamps," in this classification, does not signify or include incandescent lamp bulbs.

In addition, gas and electric fixtures, lamps, lanterns and reflectors are manufactured to some extent as secondary products by establishments engaged primarily in other lines of manufacture. The value of such commodities thus produced outside the industry proper in 1925 was $10,005,944, an amount equal to 7.7 per cent of the total value of products for the industry as classified. The corresponding value for 1927 has not yet been calculated, but will be shown in the final report of the census.

Of the 481 establishments reporting for 1927, 156 were located in New York, 76 in Illinois, 57 in California, 39 in Pennsylvania, 32 in Ohio, fifteen in Massachusetts, fifteen in New Jersey, fifteen in Wisconsin, fourteen in Washington, thirteen in Missouri, eleven in Connecticut, seven in Indiana, six in Maryland, six in Michigan, five in Minnesota, three in Oregon, two in Colorado, two in Iowa, two in Kansas, and one each in Kentucky, Louisiana, Oklahoma, Texas and Virginia. In 1925 the industry was represented by 517 establishments, the decrease to 481 being the net result of losses and gains.

The statistics for 1927 and 1925 are summarized in the accompanying table. The figures for 1927 are preliminary and subject to such correction as may be found necessary after further examination of the returns.

	1927	1925	Per Cent of Increase (+) or Decrease (—)
Number of establishments	481	517	—7.0
Wage earners (average for the year)[1]	21,030	22,334	—5.8
Wages[2]	$29,260,824	$31,072,058	—5.8
Cost of materials, factory supplies, fuel, and purchased power, total[2]	55,608,545	57,770,818	—3.7
Materials and supplies	54,214,643	(3)	.....
Fuel and power	1,393,902	(3)	.....
Value of products[2]	127,802,407	129,698,389	—1.5
Value added by manufacture[4]	72,193,862	71,927,571	+0.4
Horsepower	31,291	30,038	+4.2

[1] Not including salaried employees.
[2] The amount of manufacturers' profits cannot be calculated from the census figures, for the reason that no data are collected in regard to a number of items of expense, such as interest on investment, rent, depreciation, taxes, insurance and advertising.
[3] Not reported separately.
[4] Value of products less cost of materials, factory supplies, fuel and purchased power.

Electrical Goods Distribution Subject of Study

FOR the purpose of better ascertaining the distribution of electrical goods, the electrical division of the Commerce Department is completing plans for a national census taking among the various retail units handling electric refrigerators and heating appliances. This study will comprise two distinct surveys—one covering refrigerators and the other devoted exclusively to heating appliances. It is expected that a further survey will be made to check the distribution of motor-driven apparatus.

As the result of these studies, it will be possible to establish the percentage of the entire business in each type of article that is done by the various retail units. A survey that is being completed of the distribution of radio goods, for instance, has shown, according to tentative findings, that there are nearly a hundred different types of establishments handling these articles, ranging from beauty parlors to garages. It is expected that the same situation will be revealed with regard to the electric appliances—a large number of outlets, but a few of them controlling the greater part of the business.

Particular attention will be directed toward finding out the percentage of the appliance business that is done by the central stations. It is believed that the findings will disclose that the central stations do not dominate the market for electrical apparatus taken as a whole, although it may be shown that there are certain types of appliances that they are obliged to concentrate on because no other establishment desires to do so. When the true picture of the part that central stations play is presented, it is thought the agitation will be largely dissipated.

Protests have been made to the Federal Trade Commission from certain refrigerator interests, it is stated, asking the commission to examine closely into the appliance sale business of the power companies. After looking into this protest, government officials do not believe that there is any ground for action. The issue has come up locally in the city of Washington of whether or not the utility companies are charging their customers in their bills for any losses that they may incur in the sale of appliances. It is believed, however, that the Utilities Commission will take no action toward a general investigation of the books of the companies unless proof is presented that losses are being passed on to the public.

Metal Markets Quiet

Following is a summary of current and last week's metal market prices:

NEW YORK METAL MARKET PRICES

	Aug. 7, 1929 Cents per Pound	Aug. 14, 1929 Cents per Pound
Copper, electrolytic	18	18
Lead, Am. S. & R. price	6.75	6.75
Antimony	8.75	8.625
Nickel, ingot	35	35
Zinc, spot	7.15	7.15
Tin, Straits	47	46.35
Aluminum, 99 per cent.	24.30	24.30

Market Conditions

ALTHOUGH the electrical equipment situation is somewhat mixed this week, some sections reflecting summer inactivity, the outlook for early autumn buying is universally favorable.

——VOLUME OF SALES IS AROUND NORMAL on Pacific and throughout Middle West. Machinery business heavy on Coast.

——BUSINESS IN CONSTRUCTION MATERIALS has declined noticeably in the Southeast, but central stations are buying actively.

——ANTICIPATION OF EXCEEDINGLY GOOD SEPTEMBER BUSINESS is strong in the Eastern district. Railway electrification is giving rise to substantial business.

EASTERN DISTRICT

BUSINESS continues satisfactory for this season in the Eastern district. Commitments show improvement since the first of the month, particularly from central stations, and inquiries from that quarter are on an upward trend. Electric railway work is helping increase the activity, and sizable transactions are maturing.

The Delaware, Lackawanna & Western Railroad is beginning purchases for its New Jersey suburban line electrification program, and has just closed bids for a quantity of wire and cable for initial installations. Contracts will soon be let for steel frame superstructure for five large power substations at different points along the route, with orders to follow closely for transformers, switchgear and affiliated equipment. Three power companies will furnish primary service for this development. A manufacturer of prime movers at Philadelphia has secured a contract from a Pacific Coast central station for two 36,000-hp. water turbines for a new hydro-electric installation, and another award from the same interest for a 13,500-hp. vertical turbine machine for another station. A New York manufacturer has taken an order from a power company in the northern part of the state for transformers, switchgear and auxiliary apparatus to an amount of $35,000. A manufacturer in the Middle West has contracted with a neighboring municipality for a 5,000-kw. turbo-generator unit, the order for boilers going to a Michigan maker. Another producer in the same district has secured a contract for two Diesel-engine generator units for an installation in a Minnesota city.

Industrial account shows little change. There is an improved demand for motors and September transactions in this line are expected to develop a high level of business. Chemical plants are active factors in the market at present, with the metal-working industries a close second. Textile mill demand is showing an upward tendency for fall commitment. A New York manufacturer of fractional-horsepower motors has secured an order from a washing machine producer in the northern section of the state totaling about $40,000. Talking-machine manufacturers are making purchases.

Electric specialty business is reaching new high levels. A manufacturer of household appliances in the Middle West reports orders on a heavy basis and has adopted a night shift at the plant to handle incoming fall deliveries. Construction projects are as follows:

The Sylvania Industrial Corporation, New York, plans transparent paper mill at Fredericksburg, Va., to cost $750,000. The General Baking Company, New York, plans plant at Detroit, Mich., to cost about $800,000, and plant at Allentown, Pa., to cost $400,000. Jamestown, N. Y., has filed plans for extensions and improvements in municipal power plant to cost $92,000. The Niacet Chemicals Corporation, Niagara Falls, N. Y., has plans for additions to cost $800,000. The New-Kanawha Power Company, New York, a subsidiary of the Union Carbide & Carbon Corporation, has secured permission for a hydro-electric power plant at Sandstone Falls, near Huntington, W. Va., to cost more than $1,000,000. The Chevrolet Motor Company, Detroit, Mich., has filed plans for an assembling plant at Tarrytown, N. Y., to cost $1,500,000. The Westchester County Board of Supervisors, White Plains, N. Y., contemplates floodlighting system and beacon lamps at proposed municipal airport to cost more than $100,000. The Stewart Motor Corporation, Buffalo, N. Y., plans rebuilding of portion of service plant recently destroyed by fire, with loss reported at $100,000. The Warner-Hudnut Company, New York, will make extensions and improvements in plant to cost $350,000. The Delaware, Lackawanna & Western Railroad Company, New York, has plans for a two-story power substation at Newark, N. J., in connection with suburban line electrification, estimated to cost $100,000. The Public Service Electric & Gas Company, Newark, N. J., will make extensions and improvements in power plant at Ridgewood, to cost $30,000. The Board of Education, Essex County Vocational Schools, Newark, will receive bids until August 27 for a boys' vocational school at Bloomfield, N. J., to cost $500,000. The General Cold Storage Company, Camden, N. J., recently organized, contemplates ice-manufacturing and cold storage plant, reported to cost $200,000. The Wood Newspaper Machinery Corporation, Plainfield, N. J., will build an addition to cost $75,000.

The John G. Lorenz Company, Philadelphia, Pa., plans addition to iron and steel mill, to cost $85,000. The Almar Stores Company, Philadelphia, will build a bakery and distributing plant to cost $400,000. The Pittsburgh Steel Company, Pittsburgh, Pa., plans byproduct plant at Gibsonton, Pa., to cost more than $2,000,000. The Nantahala Power & Light Company, recently organized by officials of the Aluminum Company of America, Pittsburgh, Pa., plans hydro-electric power plant on Tennessee River, near Fontana, reported to cost more than $1,000,000. Loyola College, Baltimore, Md., plans engineering building to cost $150,000. The People's Drug Stores, Inc., Washington, D. C., plans storage and distributing plant with manufacturing division, to cost $150,000. The Bureau of Supplies and Accounts, Navy Department, Washington, will receive bids until August 27, for two motor generator sets and spare parts, for the Mare Island and Puget Sound navy yards.

PACIFIC COAST

THE central stations on the Pacific Coast are buying fairly actively with the result that sales volume is well maintained for this season. Some substantial large equipment orders have been received as well as certain specialized product orders.

Power company purchasing includes four carloads pole-line hardware for a central stock, and the reflector and lighting installation for the San Francisco steam plant of the Great Western Power Company. Machinery business is distinguished by several unique orders such as the first Pacific Coast sale of the Sperry gyroscope stabilizer for a Long Beach steam yacht, amounting to $30,000. The first considerable sale for arc welding sets for large steel buildings was made by Westinghouse for the Southern California Edison building in Los Angeles. Other machinery sales include $15,000 worth of transformers and circuit breakers for an Arizona irrigation project, $20,000 worth general equipment for an Arizona copper mine, and a $200,000 Westinghouse turbine and accessories for an Oregon power company. Meter, small motor and transformer sales, stock sizes, continue very good. Lighting is also prominent, including a $5,000 contract for Richmond, a $100,000 estimate for the Berkeley-San Pablo job, 42 standards for Santa Rosa, 25 for San Mateo, a $5,000 job for Gustine and additions to the Monterey and Bakersfield systems. $50,000 worth of lighting material was supplied to the Glendale airport and Bakersfield is in the market for $4,000 worth of projectors. Rumors persist of the merger of three great California systems, the Pacific Lighting, Pacific Gas & Electric and the Southern California Edison companies.

The Western Pipe & Steel Company, San Francisco, gave the best bid to the board of contracts and awards, Tacoma, for steel work and appurtenances for surge tank and penstocks for Lake Cushman hydro-electric project No. 2, the figure being $453,593. The city of Tacoma on August 14 opened bids for repairing and balancing one 3,000-kw. and one 6,000-kw. turbo-generator rotor

and on August 12 for furnishing material, fabricating, painting and delivering steel towers complete for Cushman substation.

The Southern California Edison Company, Los Angeles, Calif., has approved plans for a power substation at Compton, to cost $200,000. The Delco Light Company, Dayton, Ohio, is reported planning plant in vicinity of Alhambra, Calif., to cost more than $150,000. Long Beach, Calif., plans ornamental lighting system. The Phillips & Van Orden Company, San Francisco, Calif., plans printing plant to cost $200,000. The Garden Valley Canning Company, San Jose, Calif., recently organized, plans fruit-canning plant to cost $100,000. The Pacific Coast Tanning Company, Portland, Ore., plans rebuilding of portion of plant, recently destroyed by fire with loss reported in excess of $125,000. The Washington Veneer Company, Olympia, Wash., plans mill to cost more than $100,000. The American Fire Brick Company, Spokane, Wash., plans extensions and improvements in plant to cost close to $100,000. The Olympic Products Company, Port Angeles, Wash., has plans maturing for timber and pulp mill, to cost more than $1,000,000. The M. & M. Plywood Company, Longview, Wash., plans electrically operated mill to cost $175,000. Stevenson, Wash., contemplates a municipal electric light and power plant, reported to cost about $50,000. The Golden Cycle Mill Company, Colorado Springs, Colo., plans flotation mill to cost $80,000.

Southwest

THE DEMAND for building construction materials has in the last ten days fallen off an appreciable amount. The recent hot weather in central and southwest sections has caused some good-sized rush orders for fans. A power company in the western part of this district has bought four step-up transformers, 6,667 kva., 66,000 volts, and four step-down transformers, 667 kva., all to cost about $50,000. Construction projects follow:

The Sunnen Products Company, St. Louis, Mo., will build automobile equipment manufacturing plant to cost $75,000. Kirksville, Mo., has revised plans under way for municipal electric light and power plant, reported to cost more than $85,000. The Doniphan Hydro-Electric Company, Doniphan, Mo., plans hydro-electric power plant on the Current River, reported to cost $500,000. Chatterton & Sons, Lansing, Mich., plan grain elevator at North Kansas City, Mo., to cost $100,000. The Beacon Airways of America, Inc., Kansas City, Mo., has filed plans for aircraft manufacturing plant to cost about $100,000. The Kansas Power & Light Company, Topeka, Kan., contemplates a hydro-electric power plant near Marysville, Kan., to cost $200,000. The Western Paint & Chemical Company, Oklahoma City, Okla., plans rebuilding of portion of plant, recently destroyed by fire, with loss in excess of $125,000. Swift & Company, Chicago, Ill., plans produce packing and creamery plant at Ardmore, Okla., to cost $165,000. Lawton, Okla., plans installation of floodlighting system and beacon lamps at municipal airport. Little Rock, Ark., plans municipal fire alarm system to cost about $50,000. The Panama Smokeless Coal Company, Fort Smith, Ark., plans extensions and improvements in mining plant to cost about $70,000. The Texas-Louisiana Power Company, Fort Worth, Tex., plans power plant at Yoakum, Tex., reported to cost $60,000. The Texas Power & Light Company, Dallas, Tex., contemplates ornamental lighting system at Kerryville, Tex. The Orient Petroleum Company, Wichita Falls, Tex., will make extensions and improvements in oil refinery to cost $600,000. The Dallas Lumber Company, Dallas, Tex., plans rebuilding of mill recently destroyed by fire with loss of $85,000. The San Antonio Suburban Irrigated Farms, San Antonio, Tex., plans ceramic floor and wall tile plant, to cost $100,000.

Middle West

GENERAL business in the Middle West section continues to show improvement. The volume of business is gradually increasing and the outlook for fall business is promising. The major activities, steel, agricultural, railroad and automotive industries are in a prosperous condition. Railroad equipment purchasing is still quite heavy, one railroad coming into the market for 1,000 gondola cars.

The various utility companies are busy with a normal amount of construction work. Some of the interesting orders placed this week include one for 24,000 ft. 600,000-circ.mil, single-conductor, 132-kv., oil-filled, paper-insulated, lead-covered cable, terminals, stop joints, normal joints and reservoirs for 132-kv. cable, valued at $60,000; 4,000 ft. 750,000-circ.mil, single-conductor, and 5,500 ft. 1,000,000 single-conductor, 43-kv. paper- and-lead-covered cable; 625 Thompson meters of 10 to 50 amp. capacity, 600,000 lb. triple braid weatherproof wires and cables and several construction orders, valued at $100,000.

The Outboard Motors Corporation, Milwaukee, Wis., plans $85,000 addition to marine motor manufacturing plant. Racine, Wis., plans a vocational school to cost $120,000. The Glancy Malleable Iron Company, Wauwatosa, Wis., has completed plans for additions to cost $115,000. The Auto Specialties Manufacturing Company, St. Joseph, Mich., plans $750,000 plant. The Grand Trunk Railroad Company, Detroit, Mich., plans repair shops at Pontiac, Mich., reported to cost close to $100,000. The Grand River Glass Company, Detroit, Mich., plans two-story plant reported to cost more than $70,000. The Chevrolet Motor Corporation, Detroit, Mich., will soon take bids for addition to local assembling plant to cost $200,000. The Checker Cab Manufacturing Corporation, Kalamazoo, Mich., will soon take bids for addition to taxicab manufacturing plant, to cost $450,000. Plainwell, Mich., plans floodlighting system and beacon lamps in connection with proposed municipal airport. Grand Haven, Mich., contemplates an addition to municipal electric light and power plant, to cost $200,000. The Dallas Brass & Copper Company, Chicago, Ill., has filed plans for additions to cost more than $150,000. The Ruth Automatic Garage, Inc., Chicago, Ill., has filed plans for a multi-story service, repair and garage building, to cost $1,000,000. Greenlee Brothers, Inc., Rockford, Ill., will build an addition to woodworking machinery manufacturing plant to cost about $90,000. Evanston, Ill., is completing revised plans for ornamental lighting system to cost more than $1,000,000. Bloomington, Ill., plans extensions and improvements in municipal electric light and water plants, reported to cost more than $70,000. The Inca Manufacturing Company, Fort Wayne, Ind., recently organized, will build a plant for manufacture of wire cables, etc., reported to cost $100,000. The Milroy Milling Company, Milroy, Ind., plans rebuilding of grain milling plant, recently destroyed by fire with loss of $100,000. The Mather Spring Company, Toledo, Ohio, plans plant to cost more than $200,000. The Toledo Foundry & Machine Company, Toledo, Ohio, has authorized complete electrification of plant, reported to cost $40,000. The Champion Coated Paper Company, Hamilton, Ohio, plans addition reported to cost $40,000.

New England

CENTRAL station equipment buying is spotty. Meter sales are steady and substation materials are moving in small lots. Orders for new service line materials are encouraging owing to rapid extension throughout this district. Street lighting projects are active and outside illuminated signs are gaining. Recently a number of large installations of 200-watt lamps were made. Merchandising is steady.

Orders for industrial equipment in this district were more active during the past week. Power motors, small motors and control accessories were in good demand. Of interest are noted orders of small motors for a shoe factory aggregating 224 hp., of which two were 45-hp. motors. A large group of motors, pumping units and accessories amounting to about $70,000 was placed. Orders for lots of small motors reached about $8,000 for one manufacturer. More interest is being given to new mill and factory power installations. A 500-kw. generator unit was recently ordered for a western Massachusetts plant. Negotiations are quickening a little. Orders will be placed in the early fall for several large power projects, including wheels and generators. Construction projects are as follows:

The Holyoke Water Power Company, Holyoke, Mass., is completing plans for hydro-electric power plant to cost $400,000. The Quincy Light & Power Company, Quincy, Mass., has filed plans for addition to power plant, to cost about $70,000. The Pitney-Bowes Postage Meter Company, Stamford, Conn., will build an addition to cost about $100,000.

Southeast

BUSINESS in most of the Southeastern section continues good with the outlook for excellent crops improving in middle and south Georgia. Electrical equipment business in general is going along satisfactorily. A volume of fair-sized orders is reported.

Among the larger orders are pole-line hardware approximating $4,000, insulators $7,000, arresters $1,500, transformers $6,950, together with a reasonable volume of interior work, the prin-

cipal item of which is a $5,000 order for conduit. Some pumping equipment is also on order and in prospect, totaling approximately $25,000. Business, generally, is moving satisfactorily, largely through public utility outlets. Range campaigns by the larger utilities are creating a very satisfactory movement in this line. One of the larger power companies reported the sale of 900 ranges in the past two weeks, another approximately 300 ranges, while still another has set a quota for September activities of 600 ranges. These range installations are serving to create a reasonable demand for wiring specialties and distribution transformers. Construction prospects follow:

The Standard Paper Manufacturing Company, Richmond, Va., has filed plans for an addition to cost about $80,000. The American Glanzstoff Corporation, Elizabethton, Tenn., will build an addition to rayon mill to cost $1,500,000. Jackson, Tenn., plans extensions and improvements in municipal power plant and system to cost $100,000. Meridian, Miss., plans floodlighting system and beacon lamps at proposed municipal airport to cost $50,000. The Goodyear Tire & Rubber Company, Akron, Ohio, plans fabric mill at Rockmart, Ga., to cost $750,000. The United States Phosphoric Products Corporation, Tampa, Fla., has approved plans for $500,000 acid plant. The Saniford Fish & Shrimp Packing Company, Fort Pierce, Fla., plans to build a cold-storage and refrigerating plant to cost $75,000.

Activities of the Trade

Maytag Half-Year Profits Up 27 per Cent

Net profits of the Maytag Company for the six months ended June 30 totaled $3,236,122, against $2,549,087 for the same period of 1928, an increase of approximately 27 per cent. This amounted to $1.55 per share on the common stock.

Net profit for the quarter ended June 30, 1929, amounted to $1,915,154 after charges, equal to 97 cents a share on 1,608,795 common shares, comparing with $1,320,968, or 58 cents a share, in the preceding quarter and $1,445,404, or 46 cents a share, on 1,600,210 shares in the June quarter of previous year.

Net profit for the first half of 1929 is the largest ever reported in the history of the company. Net sales were $13,106,283, compared with $11,128,292 in the first six months of 1928.

The income account for six months ended June 30, 1929, follows: Net sales, $13,106,283; cost of sales and expenses, $9,521,904; operating profit, $3,584,379; other income, $287,304; total income, $3,871,683; depreciation, $112,850; federal tax reserve, $442,000; other deductions, $80,712; net profit, $3,236,121; first preferred dividends, $264,000; cumulative preference dividends, $477,767; common dividends, $1,948,310; surplus, $546,044.

The Bryant Electric Company, Bridgeport, Conn., manufacturer of wiring devices, has arranged with the Metropolitan Life Insurance Company for an employee group insurance program. Every employee who has been with the company six months or longer receives $500 life insurance free, for which the Bryant Electric Company pays the entire cost, and he or she may purchase additional insurance through this special plan according to the salary received.

The Automatic Electric Heater Company, 1706 Race Street, Philadelphia, announces that N. Pedroso, sales promotion manager of the company has been appointed export sales manager supervising the advertising of "Sepco" products. Mr. Pedroso will go to South America to negotiate arrangements for the establishment of branches in certain Latin-American republics.

Moe Brothers Organize New Lighting Fixture Company

Moe Brothers Manufacturing Company is the name of the new Milwaukee company just organized by Henrik Moe and O. E. Moe for the manufacture of lighting equipment and kindred products. Until recently Henrik Moe, who is president of the new concern, and O. E. Moe, who is vice-president in charge of sales, occupied the same positions with the Moe-Bridges Company, Milwaukee, manufacturer of lighting equipment.

Opening of Aluminum Foundry

The editors of several technical and architectural journals were the guests of the Aluminum Company of America at its new aluminum alloy foundry in Fairfield, Conn., on August 8. The new plant replaces in greatly increased size and with more modern equipment an old plant across the street.

The intent has been to render the new plant a model establishment for alloy casting output. Electric drive for the machinery, besides electric furnaces for holding pots and heat treating, and highly refined pyrometric control are features of interest to the electrical engineer. So is the use of the X-ray for detection of flaws in the finished product.

Of interest to the metal trade is the employment of aluminum for every possible use in the equipment of the buildings. The fence along the street front, the rail at the front entrance and on stairways, the radiators, the building hardware, the electrical fittings and, in the offices, the furniture are entirely of aluminum.

The output of the plant at present is largely consumed by the aviation, automotive and electrical appliance fields.

The Worthington Pump & Machinery Corporation, New York City, reports for the six months ended June 30, 1929, a net income of $1,099,428, after charges, depreciation and taxes. This is equivalent to $6.91 a share on the combined 55,928 shares of 7 per cent class A preferred stock and 103,217 shares of 6 per cent class B preferred shares, on which both issues have an accumulation of unpaid dividends. Allowing for only regular semi-annual dividend requirements on the preferred shares, the balance is equivalent to $4.57 a share on the 129,923 outstanding shares of common stock.

The Westinghouse Electric & Manufacturing Company has purchased from the city of Newark 22 acres of land situated at Haynes Avenue and the state highway in the Port Newark development. According to officials of the company, it will eventually erect a warehouse and a service station to serve the northern New Jersey industrial area.

The Westinghouse Electric & Manufacturing Company announces that it has received an order for electrical equipment to be used in the new Chicago Civic Opera Building. The equipment consists of elevators, all heating, ventilating and pump motors, the lighting panelboards, all of the new NST type, the power and elevator panels, an alternating-current distribution switchboard, a direct-current distribution switchboard and a ten-scene "multi-preset" theater switchboard.

The Packard Electric Company, Warren, Ohio, reports net earnings for the first six months of 1929 at 31 per cent over the same period last year. Net for the first six months was $293,042, or $2.18 per share, on the common, an annual rate of $4.36. This compares with $223,243, or $1.69, for the first six months last year. The balance sheet indicates the company to be in strong position, with current assets of $1,569,007, against current liabilities of $326,565. Cash and United States Treasury certificates alone totaled $706,883, or more than twice total current liabilities.

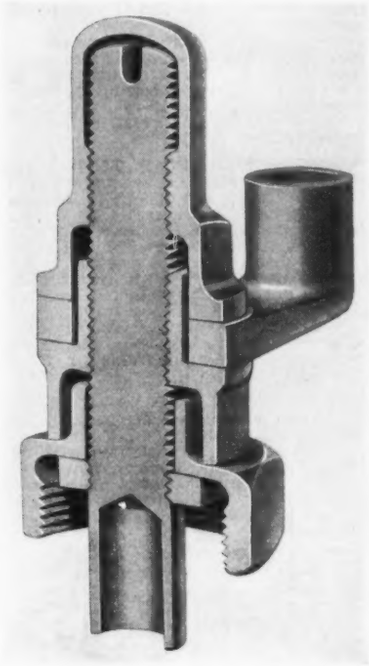
The Sheffler-Gross Company, Inc., 203 Drexel Building, Philadelphia, an engineering organization which sells heating, ventilating and power plant equipment, announces that Justin J. McCarthy has joined the company as sales engineer.

New Equipment Available

New Watertight Pothead Outdoor Terminal

The Line Material Company, South Milwaukee, Wis., has brought out a new watertight capnut terminal for its outdoor soldered terminal type potheads. The new type of capnuts, as shown in the accompanying illustration, completely covers the threaded stud and keeps the water out and also seals against compound leakage.

All nuts composing this terminal which have exposed portions to the weather have shoulders projecting upward into the nut immediately above.



These projecting shoulders prevent water from getting to the current-carrying stud. Consequently, water cannot be carried down into the bushing proper.

This type of terminal is now standard with this company and is supplied for single-, two-, three- and four-conductor potheads for every application where a soldered internal connection is used for outdoor potheads.

Explosion and Abrasion Proof Inclosed Motors

A new line of Timken-equipped explosion and abrasion proof totally inclosed electric motors in ratings of from ½ to 50 hp., 550, 440 and 220 volts, two- and three-phase, 25 and 60 cycles, has been developed by the Armour Electric Manufacturing Company. The motors are of the squirrel-cage induction type and are particularly suitable for use under conditions where the atmosphere is liable to be impregnated with explosive fumes or abrasive dusts such as chemical plants, coal mines, foundries or cement plants.

The stator is of the skeleton frame type, the frames being made of a specially heavy casting with the feet cast integral. Rigidity of construction is secured by heavy flanges and cross ribs. The core is made up of high silica steel laminations keyed to the stator ribs and having partially closed slots. The core steel has been selected as a means of improving both the power factor and the general efficiency of the motors. The windings are of the concentric type with one phase per slot. All end coils are completely taped and thoroughly insulated, the whole stator being impregnated with a moisture- and acid-resisting compound varnish. This construction results in a very rigid winding capable of withstanding all sorts of abnormal conditions both electrical and physical, according to the manufacturers.

The end shields of the explosion-proof motors are of special construction. They consist of solid heavy castings with heavy external ribs supporting an external ring. The arrangement provides a large radiating surface to dissipate the heat from the motor, the rate of dissipation being increased by a blast of air set up between the shield and the ring. Timken bearings are mounted between the caps, which are bolted to the end shield proper. The caps have fine grooves on the inner surface which extend from 1 to 2 in. along the shaft and have from 0.001 to 0.005 clearance. Grease forced into these grooves under pressure produces a steel which is both dirt- and gas-proof.

The squirrel-cage rotor is composed of steel, copper and bronze only, the connection between the bars and rings being made of a form of bronze obtained by a special process when the rings are attached.

"Cramolin" for Use on Electric Contacts

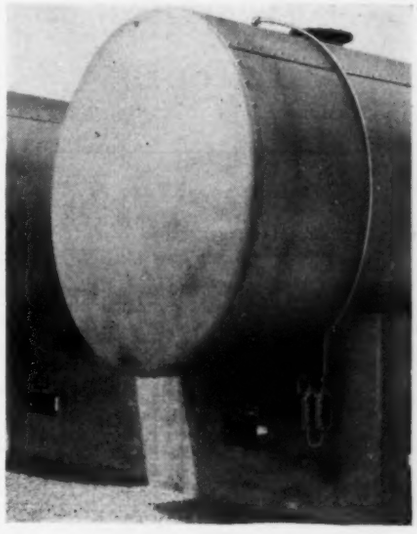
A patented liquid, designed to keep in order all running surfaces which conduct electric current, including commutators, slip rings, brushes, contact tabs in starting and regulating apparatus, controllers, lever switches, automatic devices, cell switches, short-circuiting devices, etc., is announced by Cramolin, Inc., 25 West Forty-third Street, New York City.

"Cramolin," according to the manufacturers, is a composition of constituents which automatically eliminates and removes resistance between the commutator or the slip rings and the carbon brushes. It contains no acid or other injurious ingredients, so that the commutator can be cleaned with this preparation without any fear of losing any material.

Frequently the cause of breakdowns in electric machinery and apparatus is to be found in the bad contacts between the various parts conveying the current. For example, overheated contact paths in starters or burnt places on the switch finger in the starting switches of short-circuited rotors often cause a considerable amount of trouble in starting up, and if the defects are not remedied they may result in serious damage for the machine as a whole. Poor contacts can also lead to breakdowns in the machine, to interruption of work, and to huge repair bills.

Storage Tank Anti-Breather

The Collins-Lane anti-breather attached to the vent pipes of tanks in which transformer or circuit-breaker oil is stored is designed to prevent breathing of these tanks over a wide temperature range and so enable oil to be held in storage over long periods without loss of dielectric strength. Without this apparatus air is expelled from the storage tank whenever an increase in temperature causes expansion of the oil, while moisture-laden air is drawn into the tank when the temperature is lowered and the oil contracts.



The anti-breather consists of a simple mercury trap capable of holding 5 lb. pressure or the equivalent vacuum, which is sufficient to permit a 90 deg. F. change in temperature in a tank 80 per cent filled with oil without causing air to be drawn in or expelled. Oil of high dielectric value has been held in tanks equipped with this apparatus for more than a year without detrimental effect. The Collins-Lane anti-breather is sold by the Turbine Equipment Company, New York.

Magnetic Switch Throws Motors Across the Line

A new magnetic switch, the CR-7006-D-30, is announced by the General Electric Company to supersede the CR-7006-D-4 and is designed primarily for throwing small motors directly across the line. It can, however, be used

as a primary switch for slippery motors having secondary control. It is recommended for use with small motors wherever a simple direct control providing complete protection to motor and operator is required.

The new switch incorporates modern principles from the standpoint of size, mechanical construction, appearance, electric ratings, etc. The inclosing case is of the drawn-shell type in which plenty of room is provided for wiring. The reset button for the overload relays extends through a hole in the cover, allowing its use without removing the cover. Practically all of the parts of the switch have been improved over those of the older D-4 form.

The principal changes include the use of a molded shaft which will not stick in the bearings, thermal overload relays with interchangeable heater units, silver contacts on the holding interlock, an E-frame magnet which requires a minimum of power to operate it, and restricted type blowouts.

Electrical Patents

Announced by U. S. Patent Office

(Issued August 6, 1929)

1,723,000. MEANS FOR DIVERTING ENERGY FROM CONDUCTORS; Arthur O. Austin, Near Barberton, Ohio. App. filed March 1, 1928.

1,723,010. COMMUTATOR MOTOR; Herbert L. Brump, Dayton, Ohio. App. filed Jan. 10, 1927.

1,723,016. TRIGGER SWITCH; Frank C. DeReamer, Bridgeport, Conn. App. filed Nov. 24, 1926.

1,723,035. AMMETER; Ralph Olaf Helgeby, Flint, Mich. App. filed July 13, 1927.

1,723,039. REGULATING SYSTEM; Eugene L. Hough, St. Louis, Mo. App. filed Apr. 19, 1927.

1,723,040. CIRCUIT COMTROLLER; Richard B. Hunter, Milwaukee, Wis. App. filed Feb. 2, 1925.

1,723,060. TRAFFIC SIGNAL SYSTEM; Charles W. Neill and Thomas T. Neill, Washington, D. C. App. filed July 22, 1925.

1,723,061. TRAFFIC SIGNAL OPERATING MECHANISM; Charles W. Neill and Thomas Neill, Washington, D. C. App. filed Feb. 12, 1927.

1,723,062. TRAFFIC SIGNAL CONTROL MECHANISM; Charles W. Neill, Washington, D. C. App. filed Apr. 18, 1927.

1,723,084. MOTOR STARTER; James T. Sibley, New York, N. Y. App. filed Feb. 10, 1926.

1,723,090. VOLTAGE REGULATING SYSTEM; Alexander R. Stevenson, Jr., Schenectady, N. Y. App. filed July 2, 1925.

1,723,093. VAPORIZER; Lloyd C. Strite, Minneapolis, Minn. App. filed Sept. 13, 1928.

1,723,103. SWITCH OPERATING MECHANISM; Ludvig S. Walle, Scotia, N. Y. App. filed Jan. 29, 1927.

1,723,107. METHOD OF AND MACHINE FOR SEALING MOUNTS INTO BULBS: Marinus Wildeboer, Eindhoven, Netherlands. App. filed Oct. 27, 1927.

1,723,111. ALTERNATOR WITH INHERENT REGULATION; Earl R. Witzel, Kohler, Wis. App. filed June 27, 1928.

1,723,132. CONDENSER; Alva J. Carter, Chicago, Ill. App. filed July 6, 1926.

1,723,154. ELECTROLYTIC CELL AND SOLUTION THEREFOR; William H. Grimditch, Philadelphia, Pa. App. filed March 18, 1925.

1,723,155. SOLUTION FOR ELECTROLYTIC CELLS: William H. Grimditch, Philadelphia, Pa. App. filed Nov. 14, 1925.

1,723,172. LIQUID MEASURING DEVICE; Merion J. Huggins, Upper Saddle River, N. J. App. filed May 26, 1922.

1,723,219. ELECTRIC SIGNAL SYSTEM; Thomas H. Thomas, Edgewood, Pa. App. filed Aug. 8, 1927.

1,723,222. SPEED INDICATOR SIGNAL; Frank S. Wattells, Chicago, Ill. App. filed Jan. 31, 1924.

1,723,239. THERMOSTAT APPARATUS FOR WATER HEATERS; Emil Howe, San Gabriel, Calif. App. filed Oct. 14, 1925.

1,723,242. CONTACT UNIT FOR TYPEWRITER KEY PUNCHES; William W. Lasker, Brooklyn, N. Y. App. filed Mar. 3, 1925.

1,723,261. COIL AND METHOD OF WINDING THE SAME; Richard Varley, Englewood, N. J. App. filed June 10, 1926.

1,723,275. ELECTRICAL INDICATING INSTRUMENT; Philo M. Gelatt, LaCrosse, Wis. App. filed Aug. 24, 1925.

1,723,277. ALUMINUM PLATED ARTICLE AND PROCESS FOR PRODUCING THE SAME; Daniel Gray and Richard O. Bailey, Oneida, and William S. Murray, Utica, N. Y. App. filed Apr. 5, 1924.

1,723,282. VEHICLE DRIVING APPARATUS ANL SYSTEM; Alan Varley Livingston, New Haven, Conn. App. filed Apr. 11, 1925.

1,723,283. VEHICLE DRIVING APPARATUS AND SYSTEM; Alan Varley Livingston, New Haven, Conn. App. filed Apr. 11, 1925.

1,723,284. VEHICLE DRIVING APPARATUS AND SYSTEM; Alan Varley Livingston, New Haven, Conn. App. filed Apr. 15, 1925.

1,723,285. VEHICLE DRIVING APPARATUS AND SYSTEM; Alan Varley Livingston, Englewood. N. J. App. filed, June 6, 1925.

1,723,289. CIRCUIT CONTROL SYSTEM; Robert Mayne, Cleveland, Ohio. App. filed April 15, 1927.

1,723,290. LATCHING MECHANISM; John Robert McFarlin, Philadelphia, Pa. App. filed Nov. 10, 1924.

1,723,331. CRANK CASE HEATER; Dwight P. Cutler, Rockford, Ill. App. filed May 16, 1928.

1,723,322. ELECTRICAL RELAY CONTROL APPARATUS; Fritz Andorff, Viernheim, Germany and Kurt Landsmann, Mannheim, Germany. App. filed Mar. 8, 1926.

1,723,333. SYNCHRONOUS INDUCTION MOTOR APPARATUS AND OPERATION; Adolf Doswald, Baden, Switzerland. App. filed May 13, 1926.

1,723,371. COMBINED TOOL HANDLE AND SWITCH; Oscar H. Pieper, Rochester, N. Y. App. filed Dec. 12, 1924.

1,723,378. DISTRIBUTOR; Louis B. Sauer, Western Springs, and George A. Yanochowski, La Grange, Ill. App. filed Aug. 8, 1924.

1,723,379. AUTOMATIC SUBSTATION CONTROL; Fritz Schmidlin, Baden, Switzerland. App. filed May 25, 1927.

1,723,405. ELECTRIC HEATER; James H. Carmean, Kansas City, Mo. App. filed Apr. 13, 1928.

1,723,406. HEATER; James H. Carmean, Kansas City, Mo. App. filed Aug. 13, 1928.

1,723,409. ELECTRICAL MACHINE ROTOR; Leopold Cogneau, of Montigny sur Sambre, Belgium. App. filed June 20, 1928.

1,723,463. COMBINED LICENSE PLATE HOLDER AND SIGNAL; Henry Brewster, New York. App. filed Apr. 17, 1925.

1,723,471. LAMP SUPPORT; William G. Dunham, Schenectady, N. Y. App. filed Nov. 21, 1927.

1,723,480. ELECTROPLATING MACHINE; Albert H. Hannon, Chicago, Ill. App. filed Mar. 31, 1927.

1,723,525. ELECTRIC CURRENT RECTIFIER; Samuel Ruben, New York City, N. Y. App. filed June 22, 1925.

1,723,579. ELECTRIC CURRENT RECTIFIER; Samuel Ruben, New York, N. Y. App. filed May 13, 1926.

1,723,580. ELECTRIC CURRENT RECTIFIER; Samuel Ruben, New York, N. Y. App. filed Mar. 30, 1927.

1,723,582. ELECTRODE FOR ELECTRIC FURNACES; Mathias Ovrom Sem. Oslo, Norway. App. filed April 7, 1927.

1,723,583. ELECTRICAL RECTIFYING SYSTEM; Harry Shoemaker, Jersey City, N. J. App. filed Jan. 12, 1926.

1,723,584. RECTIFYING DEVICE; Harry Shoemaker, Jersey City, N. J. App. filed Mar. 5, 1926.

1,723,596. GROUND CONNECTION; George E. Allen, Buffalo, N. Y. App. filed June 14, 1928.

1,723,602. DIATHERMIC APPARATUS FOR TREATING CERTAIN DISEASES; De Forest B. Catlin, Boston, Mass. App. filed Oct. 3, 1925.

1,723,607. ELECTRIC HAMMER AND SIMILAR TOOL; Manuel D. Dominguez, New Orleans, La. App. filed Jan. 7, 1927.

New Trade Literature

LARGE VERTICAL MOTORS.—Wagner Electric Corporation of St. Louis has issued a new bulletin, No. 159, on large vertical motors, covering all types, in ratings of 1½ to 30 hp. As illustrated by diagrams in this bulletin a unique feature of these motors is that they all have the same flange or lug dimensions, making it possible for manufacturers and users of small motor-driven machinery to interchange motors of different types and ratings on the same mounting dimensions. This convenient feature makes it entirely unnecessary to change the mounting base in order to interchange vertical motors of different types and ratings, effecting a saving in time and expense for manufacturers and users of machinery operated by vertical or flange-mounted motors.

INSTRUMENTS FOR THE POWER PLANT is the title of an unusually well illustrated bulletin—No. 115-2, just issued by the Foxboro Company. This bulletin goes into great detail with regard to the type of instruments needed for specific purposes, discussing the various qualities which are essential. It illustrates and describes in detail such products as recording gages, recording thermometers, multiple pen recorders, steam-flow meters, etc. A cross-sectional diagram of a power plant, illustrating some applications of Foxboro instruments, is shown.

SILENT CHAIN DRIVES.—Catalog No 628, the new catalog of the Ramsey Chain Company, Inc., Albany, N. Y., is just off the press. It is well illustrated with applications of the chain drive in power transmission. All applications are carefully discussed and frequently small design diagrams are added for clarity. The publication contains 85 pages.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency and purchase are desired in Saigon, Indo-China (No. 41,140), for storage batteries.

An agency is sought in Toronto, Can. (No. 40,166), for drills, valve seaters and valve facers.

An agency is desired in Aguadilla, P. R. (No. 40,203), for electrical fans, irons and stoves.

Purchase is sought in Montevideo, Uruguay (No. 40,162), of electric ironing and dishwashing machines.

An agency is desired in Berlin, Germany (No. 40,167), for lighting fixtures.

An agency is sought in Montreal, Canada (No. 40,213), for household lighting fixtures.

An agency is looked for in Wellington, New Zealond (No. 40,164), for time switches and house meters.

Purchase is desired in Lyons, France (No. 40,161), of stranded, insulated wire for telephones.

An agency is sought in Hamburg, Germany (No. 40,163), for wire and cable.

An agency is desired in Aguadilla, P. R., for electrical wiring supplies.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for
the Use of All Interested in Analyzing the
Trend of the Electrical Business

After Customer Saturation, What Then?

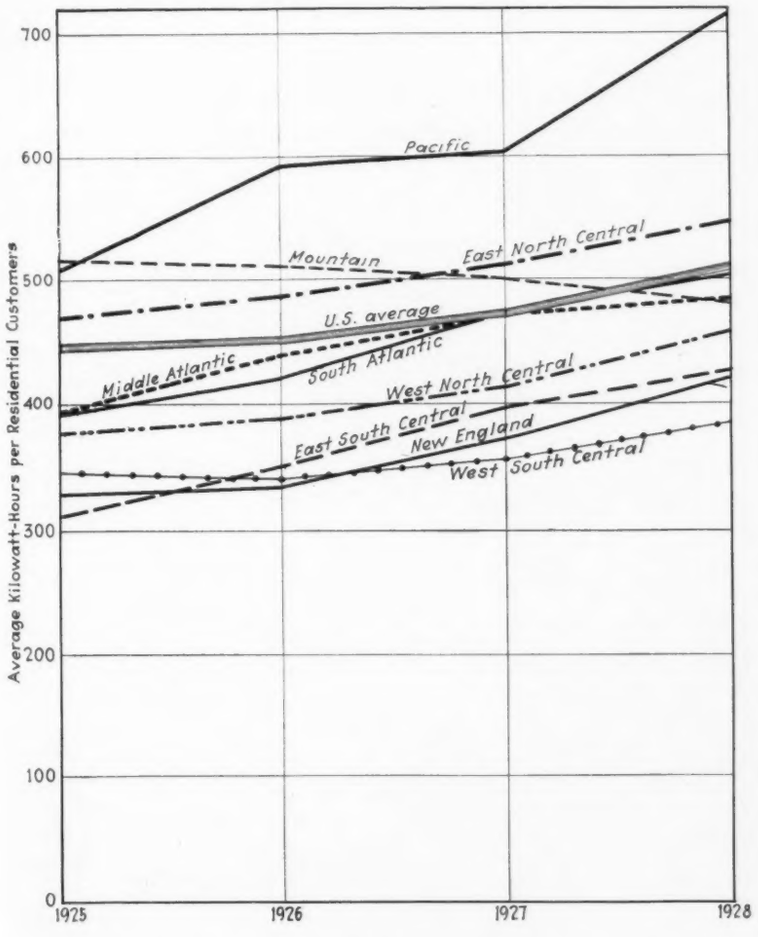
THE average energy consumption per residential customer was 13 per cent greater in 1928 than in 1925. That is the record of 41 large companies, each with an output of more than 100,000,000 kw.-hr. annually, selected because they afforded the necessary statistics. Their average rose from 447 to 507 kw.-hr. in three years. Their rate of growth is typical, although their consumption per customer exceeds the national average. During 1928 fewer new customers were taken on than during the preceding year, but the load showed no such retardation of growth. In fact, the increase in sales per customer was as great as in the two preceding years combined.

Nor is this true only for the country as a whole. It applies more or less closely to each of our nine geographical regions, with one exception, as is evident from the chart.

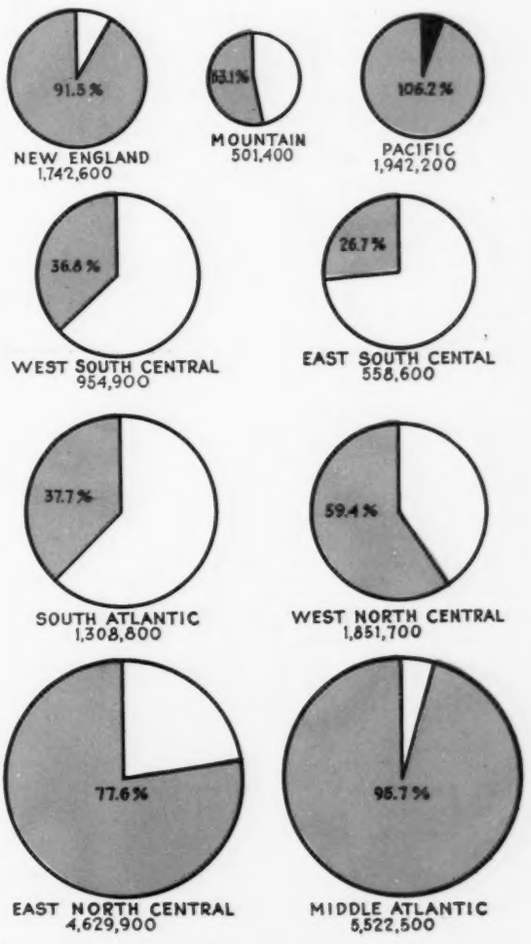
What of the future? About 68 per cent of our population now have electric service. The ratio runs higher in the sections having a large urban population and on the Pacific Coast. The smaller percentages are in those parts that have extensive areas of low population density, difficult and costly to reach.

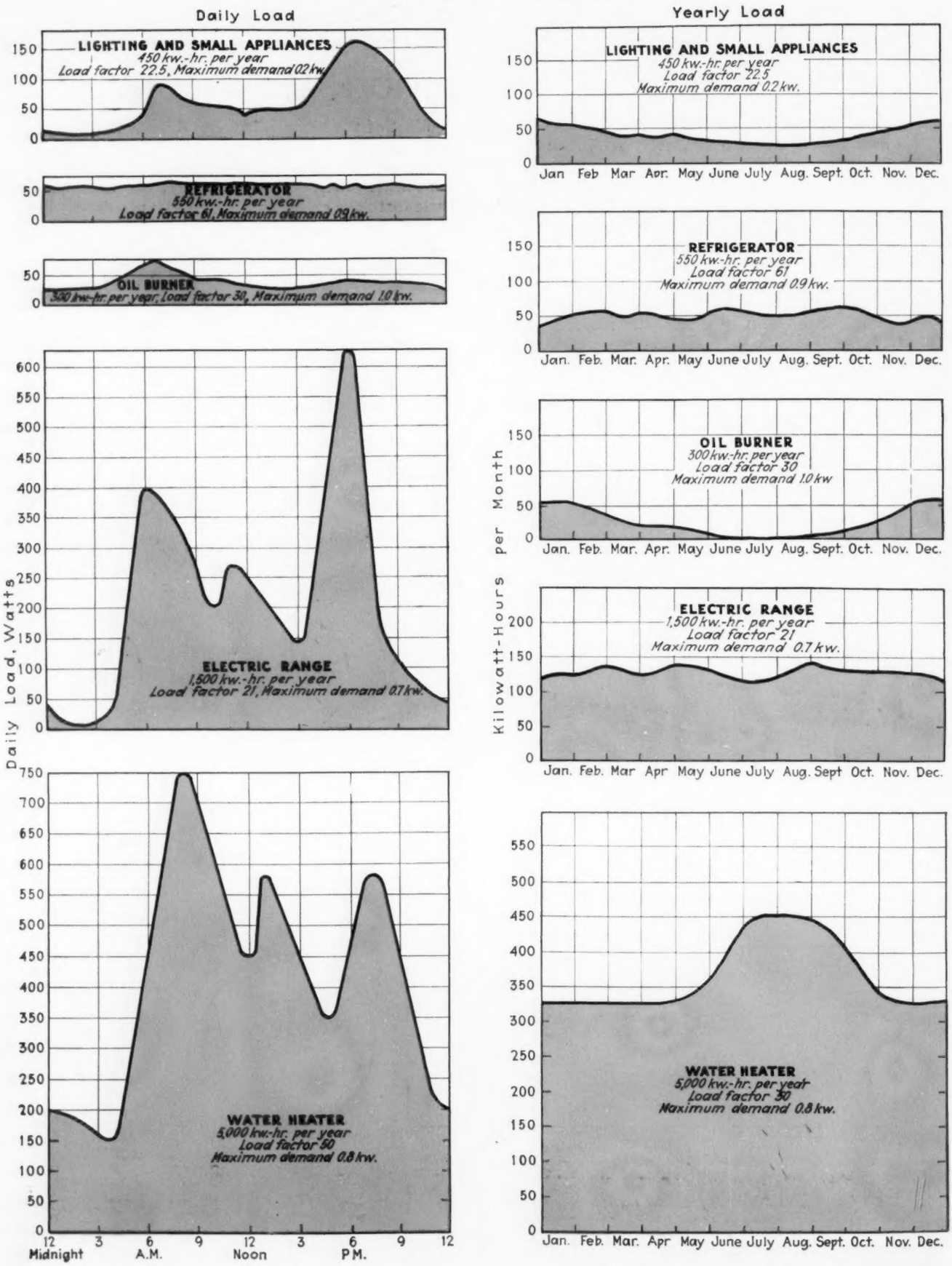
Evidently slow numerical growth is no bar to increased consumption. One of these companies has brought its average for 1928 up to 1,547 kw.-hr. per customer. There must be many individual users who far overshot this figure.

How can a further large increase be achieved? One suggestion recently made was to push the sale of full electric service, which has been estimated at 7,800 kw.-hr. annually per home. Meanwhile a group of the commonly used devices, such as flatirons, toasters, coffee percolators and fans, is good for 200 to 300 kw.-hr. a year.



Weighted Average Energy Use per Customer by Geographical Regions
Based on reports of 41 large companies



Number of Residential Customers and Per Cent of Families Having Electric Service

Component Loads of the All-Electric Home